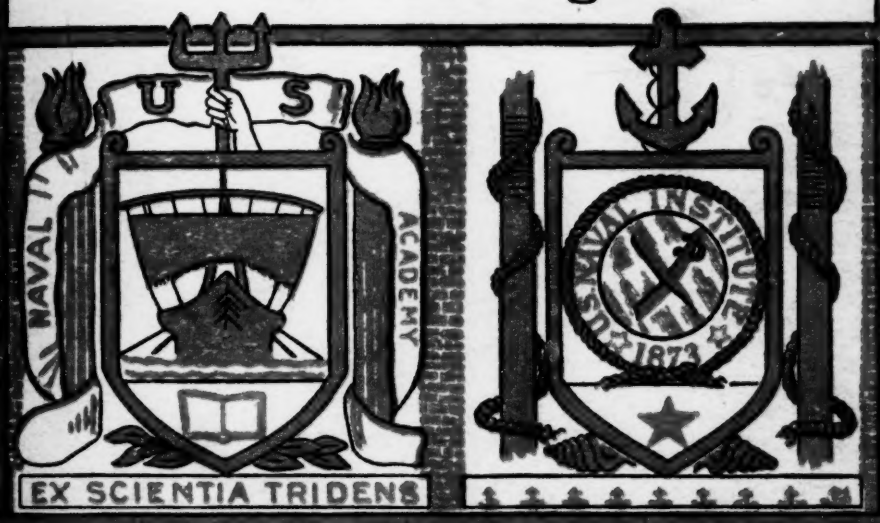
623.6
1585

VOL. 40 JANUARY-FEBRUARY 1914 No. 149

United States Naval Institute Proceedings

FEB 24 1914



The writers only are responsible for the contents of their respective articles

CONTENTS

	PAGE
Secretary's Notes	vii
War and Policy.—McKean	1
A Higher Standard of Discipline.—Durr	17
All Torpedoes!—Cuniberti. Tr. Withers	27
Loss of Life by Drowning in Naval Warfare.—Richards	33
Emergency Repairs to a Destroyer.—Hellweg	63
Fuel Oils: Their Origin, Production and Treatment.—Day	79
The Expeditionary Work of the Quartermaster's Department.—Manney	103
A Half Century of Naval Administration in America, 1861-1911.—Paullin	111
The U. S. S. "Independence": An Appreciation.—Farenholt	129
Time Element in Maneuvering.—Burrage	135
Advantages of the Gyro Compass.—Byrd and Saunders	141
Some Suggestions in Practical Navigation.—Hepburn	145
Moral Training in Preparation for War.—Bakewell	157
Discussion	177
Questions and Answers	180
Book Notices	182
Professional Notes	185
Annual Financial Report of the Secretary and Treasurer of the U. S. Naval Institute	279
Naval Academy Graduates' Association	282
Notice.—Extract from Constitution	285
Special Notice.—Naval Inst. Prize Essay	286
List of Prize Essays	288
Advertisements.	

Copyright, 1914, by E. J. King, Secretary and Treasurer, U. S. Naval Institute

Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

H. M. S. IRON DUKE

Gibb, Southsea

UNITED STATES
NAVAL INSTITUTE
PROCEEDINGS

Vol. 40, No. 1 **JAN.-FEB., 1914** **Whole No. 149**

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WAR AND POLICY[1][2]

By CAPTAIN J. S. MCKEAN, U. S. Navy

Policy.—The Century Dictionary defines "Policy" as an object or course of conduct, or the principle or body of principles to be observed in conduct; specifically, the system of measures or the line of conduct which a ruler, minister, government or party adopts and pursues as best for the interests of the country.

There are various kinds of policies, but this discussion is limited to National Policy. National policies are divided into two general classes: (a) Foreign or External, (b) Domestic or Internal.

The latter, domestic or internal policies, are in the domain of politics—the conflicts between party policies which are settled at the polls by the votes of the citizens of the various states and with which the military service has nothing to do.

[1] AUTHOR'S NOTE.—This paper is largely made up of extracts from the following:

Jomini: Art of War.
Clausewitz: On War.
Wilkinson: War and Policy.
Hill: Co-ordination Before and During War.
Roberts: Fallacies and Facts.
Taylor: History of International Law.
Murray: The Future Peace of the Anglo-Saxon.
Latane: Diplomatic Relations of the United States and Spanish America.
Moore: American Diplomacy.

[2] EDITOR'S NOTE.—Lecture delivered before the Army War College, Session 1912-1913.

276016

The foreign or external policies are established by the government (acting for the people) and are in the domain of international law, and conflicts under them are settled by diplomacy or war. It is this class of policies (foreign or external ones that may ultimately bring on war) that we are specially studying, in an effort to determine the proper relation between War and Policy.

Foreign policies may also be divided into two classes: (a) Offensive, those looking toward increasing our territory or interests beyond their present limits, and (b) Defensive, those intended to protect our present interests and territory from the aggression of other nations.

Offensive policies call for *offensive strategy* to enforce them, while *defensive policies* will only require *defensive strategy* for their maintenance. This will serve as an illustration of the close relation if not identity of *foreign* policy and *military* policy: Lord Roberts, in "Fallacies and Facts," says, "Foreign policy and military policy are, in fact, only different aspects of the same thing—the *external policy* of a nation."

All modern wars are caused by conflict of national policies; and as policy determines the political objective which in turn controls the military objective, it becomes absolutely essential that the naval and military branches of the government be in touch with, and have an understanding of, the policies announced by the State Department to the other nations, so that, when *diplomacy* proves inadequate, *war* may take its place and the substitution of "battles" for "diplomatic notes" be made without delay.

"An ideal policy would be one with a grand aim and a great force behind it; pursued with consistency from generation to generation, never deviating from its course and utilizing every opportunity to approximate toward its final object. In democratic states lack of continuity and persistence, due to change of officials, make policies weak. An autocratic state possesses three great advantages: (1) greater continuity of policies, (2) greater ability to obtain allies (having a permanent government independent of parties it can make agreements for longer periods), and (3) more experienced ministers, owing to longer continuance in office."

"The first mark of competence or efficiency of a government in relation to an international conflict is the clearness with which it knows its own mind, the facility with which it distinguishes between aims which are vital and must therefore be pursued without

hesitation, whether in peace or war, and those which are subordinate and accidental."

"Under a despotic ruler one head alone settles the policy of the state and directs the strategy during war. Under democratic rule statesmen and politicians representing parties frame the foreign policy; and a different set of men, the military leaders, plan and carry out the war. This brings about the difficulty of insuring harmony and co-operation between policy and strategy."

It is only possible to obtain a proper conception of policy, if we regard it as continuous both in peace and in war, using sometimes diplomatic negotiations, sometimes war negotiations, as circumstances require, to attain the political object.

It is a mistake to suppose that when diplomatic negotiations cease (for they do not cease) they are continued in another form —that of war. The statesman still retains control, and uses the military events as they occur to attain his object. He is still responsible for the success of the warlike as well as the peaceful policy of the nation. The statesman is therefore bound to study war as he does his other instrument—diplomacy. This means only the general principles of war, the means, resources, and forces required to attain the object of the war—viz., the submission of the enemy.

The *political object* of a war is determined beforehand by policy, which orders the war; determines the type of war it is to be; with what means, resources and expenditures it is carried on; when its object has been attained, and when it is to cease. In fact policy prepares for, leads up to, orders, supports, guides and stops the war.

Clausewitz said, "All the leading outlines of a war are always determined by the Cabinet—that is, by a political, not a military functionary." For this reason, war being subordinate to and a part of policy, the statesman must study war and the strategist policy.

"The director of a nation's affairs, whether he is a despotic monarch or the chairman of a committee, must be supposed, before he begins to correspond on a contentious subject with the government of another power, to determine as well as he can whether the purpose he proposes to himself is vital for the nation which he represents, so that it must be pursued at all costs, and also whether the opposite purpose of the other government is

regarded by that government as indispensable. If both sides take the matter seriously, a trial of strength is inevitable."

In a democratic state it is most important that the people should study war and take an interest in national policies; for upon the strength with which they grasp the central idea of the policy will depend its strength and continuity through successive changes of administrations.

Our policy is formulated by the President and his Cabinet; and as all are civilians, policy and strategy cannot be considered together. The Secretary of War and the Secretary of the Navy have their expert advisers, but by the time the advice gets to the Cabinet it is second-hand and liable to be more or less damaged. It would be much better, *from this point of view,* if the secretaries were officers of services they represent.

A logical order of procedure would be:

(1) The government decides on a policy.

(2) The military experts inform the government what this policy will entail should it lead to war.

(3) The government educates the nation so that it realizes its responsibilities, and prepares itself to meet them in case of war.

A government that knows its purpose will be quick to detect the beginning of a quarrel upon a vital issue; it will divine opposition in the distance and, long before there is any palpable sign of the coming struggle, will have analyzed all its possibilities, will have thought of every difficulty, and will have made ready for every emergency.

An illustration of the concrete declaration of a policy is given in the Czar's message to Alexieff in 1904:

> *This struggle must definitely assure the preponderance of Russia on the coast of the Pacific.* To attain this end it is indispensable to conquer Japan completely, to force her to submit definitely, and to deprive her of the desire for embarking on dangerous military enterprises for several years to come. If we do not do this, we shall lose all our prestige in the East. The present war is summed up in the question, *"Who will have the supremacy on the Asiatic coasts of the Pacific—Russia or Japan?"* To share and agree is impossible.

Surely a splendid policy, definitely expressed, but which failed for two reasons—Russia had not prepared to enforce it, and Japan had been preparing every day for ten years to defeat it.

It is a military platitude that the soldier is the servant of the politician, and it is therefore the duty of the statesman to ensure

by foresight that he, the soldier, shall not start a war with the odds against him.

Success or failure of a state's policy depends on the amount of armed force behind it, for upon this depends the greater or less amount of resistance-friction that it will meet from other nations. If the armed force be small, it will be checked, foiled and bullied by its neighbors, till at last it is goaded into a war which could have been avoided if its prestige, its armed force, had been greater. On the other hand, a national policy supported by a great armed force finds it opponents much more reasonable and inclined to a fair compromise; so that the greater the armed force behind the policy of a nation, the greater will be its prestige, and the more likely it is that all its negotiations will be settled by peaceful compromise, and the longer will it enjoy peace.

When a statesman has discovered that the question he is about to raise may possibly lead to the use of force, he will, if he be prudent, avoid raising it until he has satisfied himself that for the war which he may have to conduct he has secured, as far as human foresight can secure anything, the certainty of success. He may safely assume that the other side, fighting for an object of vital importance, will exert itself to the utmost of its resources. He will, therefore, take the full measure of those resources and compare it with the forces which he can bring to bear against them. If the comparison shows in his own hand such a preponderance as, making due allowance for accidents and miscalculations, gives a reasonable probability of success, he will raise his contentious question; but if the calculation shows the slightest doubt either as to the *readiness* or the *superiority* of his forces, he will use his utmost efforts to avoid a dispute until such time as his preparations are completed and the certainty of ultimate success has been practically assured.

The art of war is governed by one great principle—to secure at the outset every possible advantage of time, place, armament, numbers and morals. In modern war more depends upon what has been accomplished before the commencement of hostilities than upon what is done after the first shot is fired; and this preparation rests with the statesman, not with the military leaders. In these days, that nation which is beaten in preparation for war is already half beaten in the war itself.

"Mistakes made in the original assembling of armies can scarcely be made good during the subsequent course of the campaign" (Von Moltke); and such mistakes are usually due to the incapacity of a government to judge rightly the time when the assembling should begin.

The value of preparation is shown in another quotation from Von Moltke, "It is the sword alone that now keeps the sword in the scabbard." It is the great armies of the Continent and their complete preparation, in combination with the British fleet, that have kept the peace of Europe for the past forty years.

History shows that in practically every war that nation has been successful whose rulers have recognized that a policy is useless unless the means of carrying it out are provided.

The most important duty of the statesman is to provide the necessary *means* for carrying into effect the policies adopted. As our statesmen do not have any practical military training and do not live in a military or naval atmosphere, it is all the more important that they should supply the practical deficiency by theoretical study of the principles of war. Our Cabinet and party system of government make us, as a nation, weak in both "preparing for" and "carrying on" war. There is lack of harmony between policy and strategy and of co-operation between statesmen and military leaders. We lack both the tendency and the machinery to bring about proper co-ordination and co-operation. Responsible statesmen and military leaders must work together so as to synchronize and maintain in their due relative proportions the policy and strategy of a state. The only effective way to bring this about is by an intelligent grasp by both statesmen and soldiers of the broad principles of strategy and policy and their relation to one another. To bring this about Clausewitz says: "If war is to harmonize entirely with the political views, and the policy to accommodate itself to the means available for war, there is only one alternative to be remembered when the soldier and statesman are not combined in one person, which is, to make the commander-in-chief a member of the Cabinet."

The dependence of policy upon preparation and means was well expressed by Lord Roberts: "Whatever the object and character of a nation's foreign policy, the success of the policy is directly dependent upon the actual fighting strength behind it"; and in another form by Secretary Meyer when he said: "The Monroe Doctrine is just as strong as our fleet, and no stronger."

"If you wish for peace prepare for war" is another form of "In time of peace prepare for war." Our wars have shown the folly of the other method, *i. e.*, "In time of peace prepare for peace and in time of war prepare for war." This latter method increases ten-fold the cost in time, money and lives, and may lead to national humiliation.

The better the preparation the shorter the war, the less the cost in both time and money; and the poorer the preparation the longer and more expensive the war.

That the preparation of *means* and *plans* for war is not a new idea can be gathered from the following Biblical quotation:

"What king going to war against another king, sitteth not down first and consulteth whether he be able with ten thousand to meet him that cometh against his with twenty thousand? Or else, while the other is yet a great way off, he sendeth an ambassage and desireth conditions of peace."

"The right can often only be maintained by force; and the great test of character for nations, as for men, arises when they are confronted by a dilemma which requires them either to risk their existence in a conflict for the support of what they believe to be right, or to commit moral suicide by acquiescence in what they know to be wrong."

War.—This brings us to the definition of "War." Wilkinson says: "War is a form of political action, the only means by which a nation can assert against challenge its conception of right." Again, "War is a part of policy, the means whereby a nation attempts to enforce its will upon another nation and to obtain its political object by force." Every negotiation implies in itself that the pen is in one hand and the sword in the other. The pen and sword are the two mutually complementary instruments of state policy—*diplomacy* and *war*. As a further illustration, "War is merely a means to an end; it is a piece of political action." No statesman in his senses would resort to violence and bloodshed if he saw a way to attain his object without them; still less would any prudent man wish his nation to make the sacrifice and run the risks involved unless he was satisfied of success. One of the many definitions of War given by Clausewitz is as follows: "Violence arms itself with the inventions of art and science in order to contend against violence. Violence, that is to say physical force, is therefore the means; the compulsory submission of the enemy to

our will is the ultimate object. To attain this object fully the enemy must be disarmed—the real object of hostilities."

"War is not a science. It may rather be compared to a business for the successful management of which a number of sciences and arts must be mastered."

"The popular belief regards war pre-eminently as the domain of luck and pluck. The strength and courage of the soldier and the genius of the general are thought to be the essential matters. In a higher view which embraces the whole subject, courage and right leading are consequences rather than causes—are the result of sound management of a nation's affairs."

It is a generally recognized principle of war, that once war has been declared, the method of its conduct should be left to the discretion of the commander-in-chief, who should be given a free hand in carrying out his plans; but, unfortunately, time after time the commander in the field has been interfered with from the seat of government, has had his plans thwarted and has been faced with the alternative of either resigning his command or acting contrary to his best military judgment. Modern systems of communication will increase this tendency, and cutting the cable will be of no use in these days of wireless telegraphy. Every war we have ever had has shown numerous examples of this interference.

Behind the general is the government, and the best of leaders will be embarrassed and perplexed whenever, either in the preparation or during the course of a war, his government fails to know its own mind—that is, fails to have a well-understood policy.

The above discussion of policy and its relations to the war which may follow its enforcement shows the necessity of: First, a definite well-considered *policy;* second, thorough and complete *plans* to be followed in enforcing the adopted policy; third, supplying the *means* to carry out the plans; and fourth, *some governmental organization* to bring policy, plans, and means into harmonious co-operation toward the common objective—the purpose of the policy.

In an absolute monarchy this co-ordination of effort is simple, as all the elements—*policy, strategy* and *preparation*—are under one head, the Monarch, who is often commander-in-chief as well. This simplifies difficulties and leads, under an able head, to great efficiency.

In our country the various elements are in different hands—*policy,* in the hands of the President and his Cabinet; *strategy,* in the hands of the military and naval experts; the providing of the *means* or *preparation,* in the hands of Congress—and to be successful each of these elements (policy, strategy and means) must, in a general way, be known to and approved by the people to assure proper support. There is at present no organization by which co-operation, co-ordination—in short, unity of purpose and unity of action—can be brought about.

There are two methods suggested for correcting this weakness of our government:

First, to fill the offices of Secretary of the Navy and Secretary of War by carefully selected officers of the navy and army respectively. This would harmonize policy and strategy in the Cabinet by bringing the Secretary of State, representing policy, in touch with strategy and the military secretaries in touch with policy; but it is defective in that, while it might determine the means necessary, the secretaries would not be in such direct contact with Congress as to assure that these necessary means would be provided. There is also the fundamental objection of our people to having military officers form a part of the civil government.

A second and more popular method of overcoming our difficulties is by the formation of a Committee of National Defense made up of the Cabinet members representing policy and strategy, of army and navy experts representing strategy, and of influential members of both houses of Congress to represent means for preparation. This plan is now before Congress in the form of a bill to organize a Council of National Defense. The bill presented did not include the Secretary of State and was weak in that respect, but has been amended to include him.

As national defense is the highest duty of a statesman it is difficult to understand anyone objecting to serving on such a committee. This committee has the President as chairman *ex-officio.* It is not to meet in time of war and will therefore not interfere with strategy. It is suggested that the bill should be further amended so that the military and naval members form a joint board of advisers to the President during the war. He must have such advisers; and if they are selected during peace to make plans for war, for the success of which they will be responsible, the President will get much more valuable advice than from any vol-

untary or impromptu board he may be forced to rely on, if no legal one is provided.

Here it may be well to state what the army and navy are doing, and to suggest what they can do, to bring about co-ordination and co-operation within and between the two services.

At each of the War Colleges officers of all branches of the service, except chaplains, are being educated and trained to know the difficulties of war and the approved methods of meeting them.

The War Colleges are sending their graduates to the sister college, both as students and as advisers to or members of the faculty, and each service is thus educating and training a few officers to understand the language and the difficulties of the sister service, and fitting them to act as interpreters between their respective commanding officers in combined operations.

To bring about the necessary co-ordination of effort between the various organizations of the navy engaged in the preparation of the fleet for war, the Aid for Operations, the General Board, the Office of Naval Intelligence and the Naval War College, or—to give the duties rather than the titles—the Chief of Staff, the War Plans Section, the Information Section and the Educational Section, should be housed in one building in Washington under the direction of a single head—the Aid for Operations or Chief of Staff.

To co-ordinate the two services the two colleges should physically be connected by an auditorium, where both colleges would meet to solve combined problems and discuss combined operations theoretically in time of peace as the two services will solve combined problems practically in time of war. This would also make available to each service the mass of valuable information in the archives and libraries of both.

The best suggestion that I have heard as to how to bring about efficient co-ordination and therefore intelligent co-operation in both peace and war, was made by Major Jadwin, Engineer Corps, U. S. Army, that we go back to a single Department of National Defense headed by a Secretary for National Defense, with the Army Section headed by the *Chief of Staff* of the Army, and the Navy Section by the *Aid for Operations*. This would provide for joint effort under a single control, would prevent duplication of effort and expense, would increase efficiency and would result in the President and Council of National Defense getting advice

from a single source and the Congress being asked for a single appropriation to cover a combined budget for national defense, and would inevitably bring about a better balance and proportion between the various parts—the Fleet, the Coast Defense and the Mobile Army—for each would be developed scientifically to meet the most probable enemy in the enforcement of each of our national policies, and all would be educated and trained to co-operate intelligently and efficiently in accordance with a single doctrine of war.

Even with one of the above plans in operation, we have no scheme for the education of the people so that the whole country would understand and support the government in carrying out any of our policies. This cannot, under a system of party government, well be carried out by any official organization, but must be left to some voluntary society, such as the Navy League, which should receive direct encouragement and sympathetic aid from the government. Such voluntary organizations have their greatest use in time of peace—that is, during the time in which we must prepare for war.

We have several well-recognized policies which in the course of time have come to be generally accepted by the people and by both political parties, either of which may, under certain conditions, directly or indirectly cause war.

Our well-established national policies are as follows:

First: "No Entangling Alliances." This was given its first formal expression in Washington's Farewell Address, and has been referred to in many state papers since. It grew out of the difficulties with France during Washington's administration. While undoubtedly the oldest and probably the most generally accepted policy, its importance in relation to strategy and means has not been appreciated. This policy, in its consequences, logically bars us from having the support of allies and, with equal logic, calls for such plans and preparations as will enable us to protect ourselves and our policies against any other power or powers that may oppose them.

The next policy in point of time, "The Monroe Doctrine," was first formally announced by President Monroe in his message to Congress, December 2, 1823. This policy grew out of two distinct situations—Russia in Alaska and the plan of the Holy Alliance (Russia, Austria, Prussia) as expressed in the "Treaty of

the Holy Alliance," Article 1 of which announced their intention to "put an end to the system of representative governments in whatever country it may exist in Europe, and to prevent its being introduced in those countries where it is not yet known." The country referred to was Spain, and the plans included the Spanish colonies in America which were then in revolt.

The two parts of the Monroe Doctrine appear in separate paragraphs in the message. The first part forms the concluding sentence of the paragraph referring to Russia's proposal for a settlement of the dispute between England, Russia, and the United States as to the boundaries between Alaska, British Columbia, and the Oregon Territory; it is:

"In the discussions to which this interest has given rise and in the arrangements by which they may terminate, the occasion has been judged proper for asserting, as a principle in which the rights and interests of the United States are involved, that the American continents, by the free and independent condition which they have assumed and maintain, are *henceforth not to be considered as subjects for future colonization by any European powers.*"

The second paragraph refers to the threat of the Holy Alliance to re-establish the Spanish monarchy in the revolted colonies whose independence the United States had recognized. The substance of this part of the doctrine was expressed as follows:

"We owe it, therefore, to candor and to the amicable relations existing between the United States and those powers, to declare *that we should consider any attempt on their part to extend their system to any portion of this hemisphere as dangerous to our peace and safety.* With the existing colonies or dependencies of any European power we have not interfered and shall not interfere. But with the governments who have declared their independence and maintained it, and whose independence we have, on great consideration and on just principles, acknowledged, *we could not view any interposition for the purpose of oppressing them, or controlling in any other manner their destiny, by any European power in any other light than as the manifestation of an unfriendly disposition toward the United States.*"

The doctrine as expressed in President Monroe's message has from time to time been explained and extended by various state papers. President Polk, in a message of December 2, 1845, said, "It should be distinctly announced to the world as our settled policy, that no future European colony or dominion shall, with our consent, be planted or established on any part of the North American continent." This declaration, by the use of the word "domin-

ion," forbade the acquisition by conquest or purchase of any territory already occupied. In obedience to that principle France and Great Britain were more than once notified that the United States could not witness with indifference the transfer of Cuba and Porto Rico by Spain to any other European power.

France's intervention in Mexico was finally put to an end by a notice to France that friendship with that nation must cease "unless France could deem it consistent with her interest and honor to desist from the prosecution of armed intervention in Mexico to overthrow the domestic republican government existing there and to establish upon its ruins the foreign monarchy which has been attempted to be inaugurated in the capital of that country."

Secretary Fish, in a report to President Grant, published with the President's message of July 14, 1869, said:

"This policy is not a policy of aggression; but *it opposes the creation of European dominion on American soil, or its transfer to other European powers,* and it looks hopefully to the time when, by the voluntary departure of European governments *from this continent and the adjacent islands,* America shall be wholly America."

Secretary Fish then gives the basis of the claim:

"The United States . . . . occupy of necessity a prominent position on this continent, which they neither can nor should abdicate, which entitles them to a leading voice, and which imposes on them duties of right and honor regarding American questions, whether those questions affect *emancipated colonies, or colonists still subject to European domination.*"

President Cleveland, in his special message to Congress, December 17, 1895, in reply to the claim of the British Prime Minister that the Monroe Doctrine had been given a new and strange extension and development, said:

"The doctrine upon which we stand is strong and sound, because its enforcement is important to our peace and safety as a nation and is essential to the integrity of our free institutions and the tranquil maintainance of our distinctive form of government. It was intended to apply to every stage of our national life, and cannot become obsolete while our republic endures. *If the balance of power is justly a cause for jealous anxiety among the governments of the Old World and a subject for our absolute non-interference, none the less is an observance of the Monroe Doctrine of vital concern to our people and their government.*"

The Monroe Doctrine finds its recognition in those principles of international law which are based on the theory that every nation shall have its rights protected and its just claims enforced.

Commenting on the settlement of the Venezuela incident by

Great Britain agreeing to our acting as arbitrator, an English writer said, " It admits a principle that, in respect of South American republics, the United States may not only intervene in disputes, but may entirely supersede the original disputant and assume exclusive control of negotiations."

As illustrated above, the Monroe Doctrine has grown with the growth of the country, and now stands ready to adapt itself to all future developments. The change that has taken place is less in its outward form than in its inward spirit.

It is taken, for example, to apply to Hawaii since annexation, although not a part of the territory originally covered.

The latest extension of the Monroe Doctrine prohibits the acquirement and control by foreign steamship companies, etc., of coaling stations which might later be used by foreign governments as naval advance bases.

The third of our national policies to be considered is the so-called " Open Door " policy. In effect this guarantees " equal and impartial trade with all parts of the Chinese Empire." This policy was first announced by Great Britain in opposition to the " Sphere of Influence " policy according to which Russia, England, Germany, France, and Japan had certain well-defined areas in which their interests, influence, or control was to be primary and all others secondary. As the United States had no " Sphere of Influence " and would have been allotted no section of China, in case of partition, we stood to lose all trade opportunities in the greatest new market in the world. This state of affairs caused the then Secretary of State, the late John Hay, to send a note to Germany, with copies to the other powers, suggesting an agreement by Germany that—in view of our treaty rights—duties, taxes, etc., should be the same for all nations in the lately leased territory and port of Kiao-Chow, and stating that the other powers had been requested to make a like agreement as to the Chinese ports under their control. All the powers finally agreed. The next step was a circular note to all the powers whose troops were then marching on Pekin, requesting an agreement " to seek a solution which may bring about permanent safety and peace to China, *preserve Chinese territorial and administrative entity*, protect all rights guaranteed to friendly powers by treaties and international law, *and safeguard for the world the principle of equal and impartial trade with all parts of the Chinese Empire.*" By the acceptance of all the powers this note prevented the partition

of China and reaffirmed the policy of the "Open Door." Our government showed its sincere support of the "Open Door" by applying it to our new oriental possessions, the Philippine Islands, where the United States products pay the same duties as those from other countries.

The fourth policy, "Asiatic Exclusion," has only lately met with acceptance by the whole country. This policy is considered essential for the protection of American labor in the Pacific Coast States, and the rest of the country have accepted it as a national policy.

The latest policy is "The Exclusive Military and Commercial Control of the Panama Canal." After a prolonged discussion Congress finally decided to fortify the canal and passed laws permitting our coasting trade to use the canal free of tolls, while placing our vessels in foreign trade on the same footing as foreign vessels.

Each of the above policies calls for particular plans and means to carry them out, although the plans and means provided for one might serve perfectly in the enforcement of one, or more, of the others. In fact, were *full* and *complete* plans made and *adequate* means provided to insure the carrying out of our first and oldest policy, that of *"No Entangling Alliances"*—or, in slang, *"Playing a lone hand against the world"*—we would be splendidly equipped to carry out each or all of the others.

In addition to familiarity with our own policies and the supplying of the means to carry them out, we should study the policies of other nations, both announced and secret, so as to make the preparations necessary to defeat these should they come in conflict with out national interests.

Having provided through the Committee of National Defense to bring the *policy, strategy* and *means* together, our remaining task is to insure the education and training of our naval and military officers to make the *best plans,* to select the *best means and methods* with which to carry out these plans and, most important, to *educate the people* to understand and therefore to support the administration in its policies, the Congress in providing the means, our commanders-in-chief in the execution of the plans.

This will insure proper preparation, which will, with a nation in arms, insure success in war should it come; but will, if well done, serve its higher purpose, that of *keeping the peace.*

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A HIGHER STANDARD OF DISCIPLINE[1]

By LIEUTENANT ERNEST DURR, U. S. Navy

Motto: Malum in peius ruit,
Perfectum adhuc perficiendum potest;
Quid multa!

The need of a higher standard of discipline in the navy does not imply that the discipline is lax. Inasmuch as nothing is perfect, discipline can be improved, and it is in this spirit that the following suggestions, evolved in nearly eight years' service afloat and crystallized by one years' experience as executive of a second rate ship and as commanding officer of a small gunboat, are offered.

There have been great advances in efficiency, in general, in the last five years. But has the state of discipline kept stride with this progress? It is possible that our complacency in regard to the state of discipline comes from a very misleading comparison with past accomplishments instead of a comparison with an ideal standard. The ideal should be used for the purpose of comparison, for, although visionary as regards accomplishment, it is real as regards standard.

It is the general opinion that the officers of the navy have worked very hard, an opinion that is justified by what has been accomplished. But more could have been accomplished if part of the work had been directed towards the establishment and maintenance of a standard of discipline. Will not a close analysis show that this progress has been made solely by the use of competition stimulated by money prizes? Will it not show that competition has done that which should have been done by discipline? This does not imply that competition is harmful. On the con-

[1] EDITOR'S NOTE.—This essay was submitted in the prize essay competition for 1913 and was accepted for publication.

trary it is the most powerful agent that can be used in a service like ours to produce excellence. But has it not been given such undue prominence that we are losing sight of the fact that discipline is the only foundation upon which a military organization can be built?

There has been a tendency to slacken up on matters of discipline in order to get the crew in a certain humor for target practice. Many ships upon which this has been done have made good records. Also many ships that have not done it have made good records. While it is only the shots which hit that count it must not be forgotten that discipline is the factor that will determine the behavior of the personnel during war.

To admit the necessity for competition and its stimulation by money prizes is equivalent to an admission that the American character is incompatible with military discipline. This is true if we try to develop a discipline based on the principle of the "divine right of kings." Every American boy can rise to the highest position in the land, and he is taught this principle from the cradle as his birthright. Consequently no American boy can be expected to take kindly to the discipline exemplified in some foreign navies. It is contrary to all of the ideas he absorbed when learning patriotism, and therefore it is sensible to conform discipline to the American character instead of conforming the American character to discipline.

If we bear in mind that discipline in the American navy must be a means to an end, and not an end in itself, as it almost is in some foreign navies, the incompatibility will disappear. The product of foreign discipline is a machine, precise, exact, and perfect, but devoid of a great amount of intelligence. It is necessary to suppress intelligence in order to get the finished product. In contradistinction we want men of initiative and intelligence and must take pains to develop these qualities.

We can cultivate this form of discipline, and it will be superior to any other. We must take into consideration our national characteristics, and conform the routine at training stations and the administration on board ship so that every man has before him the knowledge that, just as the sole reason for the existence of a battleship is to fight with her guns, so his sole reason for being on board is to contribute to that end. This must be brought into direct harmony with the idea that it requires merit for a man to

keep his American birthright, and that the officers are, and must be, the judges of his merit.

In this conformation it is necessary to make use of the elemental forces that operate in the minds of all normal individuals. Without going too far into the question of ethics it may be stated as a broad principle that it is either fear of punishment or hope of reward that makes the world go round. These forces operating in the mind of the typical American boy will cause resentment if the idea of punishment is given too much prominence in the enforcement of discipline. Better results will ensue if the enforcement is based on the principle that the ultimate aim of every man is his own highest good. Highest good may take different forms in the minds of different individuals. In one it may mean a material reward or an advancement; in another it may mean the escape from or avoidance of punishment. In other words, it must be instilled into the minds of the individuals that in obeying all of the orders and regulations of the navy, they are working for their best interests in doing their duties well.

If we consider the ideal and make comparisons, it is apparent that on some ships the daily drills are carried out in a slovenly manner and incompletely. In some cases it is the direct fault of the officers; while in others it is the indirect fault of the officers who have complacently followed an antiquated system. Some men dislike drills and hate to go to quarters. Consequently there are a few yeomen, artificers, etc., who hibernate during this period. Their dislike of drills and quarters gives rise to the numerous excuses which they invent to avoid taking part in them. The toleration of such a condition is equivalent in a degree to exempting such men from the discipline of the ship.

Drills and quarters are necessary and the likes and dislikes of the men in this regard should be given absolutely no consideration. Yet drills and quarters can be made less irksome, and drills can be improved by looking at the matter from the view-point of the men. Ordinarily a drill period of an hour is assigned to a drill that should require not more than half an hour. To utilize the extra half-hour requires a tiresome repetition of the drill, or else it is carried out by fits and starts, halfheartedly, and in a slovenly manner. There is no reason to believe that even on the largest ship the longest and most tedious drill should require more than half or three-quarters of an hour. This can be accomplished by

impressing on the men that there is a standard of excellence for all drills, and that the drills will be as short as *possible* when they come up to the standard, but will be as long as *necessary* to make them come up to the standard. This is a concrete example of what constitutes highest good in a small thing. In this case "highest good" for the men, will be to avoid a tiresome repetition of the drill, and after this is brought to their attention a few times they will do their best at the first attempt. Therefore when drills are carried out in a slovenly manner by the ship's company as a whole, repeat them immediately. If only a few men are delinquent, an extra drill squad has a most stimulating effect. At the beginning this will require a little extra work on the part of the officers, and drills will often last longer than the allotted time. The executive officer especially must be constant in supervision and observation. He may find it necessary to inflict extra drills on individual divisions, but he will soon find that the division officers will pull with him in order to avoid extra drills on their own accounts.

To the casual observer the idea of spending only ten or fifteen minutes at a drill will appear outrageous. What can the men do except loaf during the remainder of the drill period? Why not permit them to loaf if they have carried out the drill rapidly and thoroughly? A repetition simply for the purpose of killing time will not make the drill any more thorough or rapid, but will have the opposite effect. Besides there is always plenty of work to do. A ship cannot be too clean. The men always work cheerfully, for they seem to look upon work as a permanent necessity and upon drill as an occasional necessity.

The following points are small things in themselves, but have considerable bearing on a proper standard:—Require every man to go to quarters, and to go at first call instead of waiting until assembly. Require all men to move on the double at all general drills no matter how trivial or unimportant their duties may appear to be. It is surprising how much time will be saved, and how much progress will be made toward a standard. It will entail a little more attention on the part of the division officers, but no division officer can spend a little time to better advantage than in anticipation and providing for all the details of the routine of his division. If the division officer is made almost supreme in his domain, and held strictly to account, he will get results in the com-

plete administration of his division which will be as gratifying as those obtained when the present system of gunnery training began. Since our discipline must necessarily differ from that of foreign navies, the standard must be based on the formative influences, the pleasures, conveniences, and development in our homes. Discipline without contentment will be a failure. The only real factors in the contentment of the men are their food and liberty. Athletics and entertainments are the only diversions. If the food and liberty are neglected no amount of attention to the diversions will produce contentment. Under such circumstances the men will look upon the diversions as cheap attempts to buy favor and will accept them with contempt. Under such circumstances discipline would be improved by omitting the diversions, no matter how much they may contribute to the desired end at other times.

No greater mistake can be made than to coddle the men. It increases the difficulty of administration, and this difficulty grows ten-fold in the case of official coddling. It never has bettered the welfare of the men and never will promote discipline or efficiency. Discipline means efficiency and can be produced after giving due consideration to the adaptability of our national character, and the opportunity for comfort and enjoyment in our homes.

Every officer must be cold-blooded in his analysis and application of the foregoing principles. To try to be popular, and this fault is more or less common, is to be more or less of a failure. On the other hand a proper understanding and a ready sympathy for the men will aid materially. In some respects the lot of the men is not to be envied. In most foreign and many home ports, their enjoyments ashore are somewhat limited.

A ready understanding of the feelings of recruits will help in many cases, and all that is needed is a little patience in order to give a man a right start who otherwise would leave the service with a bad-conduct discharge. It is now quite generally recognized that some men, who, at the beginning of their careers appear to be unfitted for the service turn out to be valuable men on board ship. The average recruit comes from a farm or an inland town, spends two or three months at a training station, and learns nothing about the navy except how to care for his clothes and keep himself clean. Next he is sent on board a cruising ship and his introduction to the service probably begins on a coal lighter shoveling coal. He is expected to fall into his place immediately. He

finds something entirely different from what he expected and is consequently lost, often for some months. Some never find themselves. It is a long step from a corn field to the gun-deck, and it is to the great credit of our American youth that so many do find themselves.

Liberty-breaking is the greatest menace to discipline with which we have to deal. This is apparent to one who has spent six months on a ship with only one instance of liberty-breaking after coming from a ship with the usual percentage of chronic offenders. After such a pleasant experience, the conclusion arrived at is that liberty-breaking should be treated as a much more serious offense. The reason that it is not so treated is because it is so common, and commanding officers have grown so used to it, that they look upon it as an incurable evil.

Yet it can be prevented or at least greatly reduced by looking at the matter from the view-point of the men and by shaping the means accordingly. There should be no deprivation of liberty as a punishment except by sentence of a court-martial. When a man is entitled to liberty, he should be permitted to go ashore unless it is necessary to keep him on board for extra drill or unfinished work, or the sanitary, political, or other conditions ashore render it inadvisable to grant liberty. As a punishment for minor offenses, deprivation of liberty, or restriction, or classing (any name will serve) is retaliative and not corrective. Any man is liable to commit a minor offense at any unguarded moment. If classing or restriction is part of his punishment, he is never sure of his liberty. Consequently when he does go on liberty he will stay overtime and get his fill on the least temptation. Incidentally, he knows that the punishment will be so light that he is willing to pay the price.

The punishment should be of sufficient severity to fit the offense. If a man was certain in the knowledge that if he stayed overtime, he would be court-martialed and lose both money and liberty, it would be very natural for him to return on time, knowing that for a petty offense committed on board he would not be deprived of his liberty.

The reason for the prevalent laxity in dealing with liberty-breakers is not hard to find. Many chronic offenders are so valuable on board ship that the commanding officer feels justified in assigning a nominal punishment in order to retain such men in

the service. No attention is paid to the demoralizing affect of a tolerated bad example, or else the commanding officer believes that the services of such men are of sufficient value to counterbalance the bad example. It is not the bad example, but it is the toleration that is harmful, and this toleration will create in the minds of other valuable men the idea that they also are exempt from discipline. The resultant progress is from bad to worse. It is not in accordance with the spirit of military preparedness, nor with natural order, that any man can be so valuable that his services cannot be dispensed with.

The question of liberty-breaking has been ably set forth by Captain W. F. Fullam, U. S. N., in his article on "Liberty-Breaking in the Fleet,"[2] an article which impresses one with its sound common sense. It shows clearly and conclusively that a commanding officer can accomplish more by applying common sense to human nature, than by applying a theory to a peculiar sort of an individual, the bluejacket, who is not less human than any other man. It appears that Captain Fullam gave the men their rights as Americans instead of privileges as bluejackets.

It is the opinion of many officers of high rank, ability, and long experience, that the navy is beginning to feel the need of a proper military spirit. This need is made apparent if the ordinary routine on any ship be closely observed. Some units of the organization are allowed to look constantly at the things at hand, instead of those which are approaching. Their perspective becomes so distorted that they lose sight of the fact that their function is to contribute to the harmonious working of the whole. Men not having specific military duties, such as the engineer's force, are more or less imbued with the idea that doing their particular work is doing their whole duty. They look upon the military drills and the military features of the routine as incidental worries which interfere with the day's work. The drills, the state of discipline, and in short everything that will have a final bearing upon success in battle, should be the day's work, and every effort should be made to develop this spirit.

The engineer's division has a routine entirely different from that of the other divisions of the ship. Is such a routine necessary

[2] "Absence Over Leave in the Fleet," by Captain W. F. Fullam, U. S. Navy; page 1103, Whole No. 140; Vol. 37, No. 4; December, 1911.

for repairs to the machinery, or for the efficient performance of the machinery? It does not seem improbable that such a routine was originally fathered by the men's aversion for drills and quarters. In order that the idea that a ship exists for the purpose of fighting shall not be lost, it might be advisable to give the engineer's force a monthly drill under arms or at the ship's battery. Machinists, boatswains, carpenters and other specialists, should have some function at all military drills for the same reason. In theory, the drill regulations provide for the manning of part of the ship's battery under certain conditions of service. Why not make this possible of accomplishment in fact? It certainly cannot be done efficiently or satisfactorily on short notice, under the existing routine.

For lack of a practical demonstration at first hand, it is possible that the casual reader will call the foregoing ideas visionary, if he does not use a stronger adjective. Yet, if intelligently and patiently applied, these principles will better the conditions on board ship, will materially raise the standard of discipline and efficiency, and at the same time make the discipline less irksome—a point which should not be passed over too lightly.

If it were not the impropriety of making invidious distinctions a practical demonstration could be furnished by the comparison of one ship with the ships of the fleet. This ship had two commanding officers in a period of eight months, both of whom believed thoroughly in the consistency of discipline and contentment. The first commanding officer had special ideas on organization which, condensed as much as possible, are as follows:

In all matters of discipline, consider things from the other fellow's point of view, before enforcing them.

Subordinate everything to efficiency in battle and thereby arrive at the greatest general efficiency without being very mediocre in any of the details incident thereto. Make the gun's crew the actual unit of organization. Make the organization of divisions, watches, and sections, incidental to the actual unit, the gun's crew, instead of making the gun's crew incidental to the organization of divisions, watches and sections.

Co-ordinate and conform all details of the organization so that there will be mutual support, and so that the most can be accomplished with the least expenditure of time and effort. Make this co-ordination and conformation simple enough to be as near fool-proof as possible.

Lastly, let there be no divided responsibility in any unit.

The mere recital of these ideas does not convey much information as to their value. The value will become apparent after the comprehensive study of a station bill constructed accordingly.

The ship was taut. The men knew exactly where they stood, and were contented. Their bearing and appearance ashore when compared with other men of the fleet was such as to excite favorable comment. The ship was always clean above and below, and the drills were excellent. The ship was very old, yet in connection with short drills and their relation to the ship's work, it is a significant fact that she needed fewer repairs than other and newer ships in the fleet.

For a period of over seven months there was only one instance of liberty-breaking, the case of a man who was unfortunate enough to get into trouble with the police on his return to the ship. During the greater part of this time the ship was alone. Part of this time was spent in ports where conditions were unfavorable for liberty-breaking. The remainder was spent in ports where conditions, especially as regards liquor and kindred vices, were very favorable. After falling in with the fleet, liberty-breaking commenced again, but it was less than was expected. The small amount was without doubt due to the pernicious effect of tolerated bad examples on other ships.

When the first commanding officer left the ship for a better command, he put all of the foregoing ideas into effect on his new ship, immediately. It is enlightening and gratifying to note that this ship won the trophy shortly afterward.

In conclusion it is possible that the above-mentioned results were accomplished by an exceptional crew under exceptionally favorable circumstances. But if there are any officers who are inclined to stand pat on the question of a higher standard of discipline, it would be interesting and instructive to hear their explanation as to why our newly-commissioned ships require such a long period to shake down.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ALL TORPEDOES!

By VITTORIO CUNIBERTI

Translated by LIEUTENANT THOMAS WITHERS, JR., U. S. Navy

(From *Rivista Marittima*. May, 1913)

"All big guns!" has been our cry for the past ten years, prior to which the armament of ships consisted of many guns of small and intermediate caliber and only four of large caliber.

The reasoning that brought us to this policy, which in former years appeared strange but is now universally accepted, was similar to that which leads us to propose another radical reform in the armament of such ships.

At that time the type of battleship was almost standardized and there was such a perfect balance between the offensive power of the intermediate calibers with a few 305 mm. (12-inch) guns, and the defensive power of the very extensive light armor and the heavy armor in the most vital parts, that we assumed that there would be a very great expenditure of ammunition before a decisive victory could be gained by one of the two fleets engaged in a battle.

Everybody has made different deductions from the battle of Tsushima; but if the Russians had been in a condition similar to the exceptionally warlike condition of the Japanese, perhaps the results would have been different. Anyhow we can state, in spite of the advocates of the intermediate calibers, that the battle of Tsushima showed the triumph of the new type of one-caliber ship.

We now find ourselves in a position similar to that of ten years ago. The offensive power and the defensive power are daily approaching equilibrium, requiring enormous displacements proportional to the increase of armor necessary for making up for the excess of power of the new guns.

If it should become necessary to increase the offensive power by further increasing the caliber, keeping twelve guns, it will be at the expense of the less important details in order to increase the thickness of the armor belt and the barbette to 400 mm. (16 inches). But in order to avoid many other phenomena of the enormous tonnage, the number of guns, as their caliber increases, will be reduced from twelve to ten, or to eight; and this will be done in order to obtain, by adequate increases of armor, equilibrium between the offensive power and the indispensable defensive power of any well-designed ship.

But we are inevitably approaching the day when there will be nothing more to be done and the naval architects will kill time in moving the little anti-torpedo-boat guns from place to place; and, perhaps, in the struggle to successfully excel themselves, they will increase the number, or the caliber, changing from the manageable 76-mm. (3-inch) to the heavy 152-mm. (6-inch), which caliber is excessive for the light plates of the destroyers and inefficient against the dreadnoughts at ten thousand meters.

As in the fashions some gentlemen keep pushing the characteristics of a type to exaggeration, until a radical change destroys their whole wardrobes at a stroke, so are we approaching the moment of the decennial change in naval fashions. In the meantime the *new* weapon has made great silent advances, and now, perhaps, it can again reach the almost defenseless hulls and bring victory.

Defending a hull from torpedo craft is, in general, much more difficult than defending the above-water part from great guns. To defend a hull properly requires great, almost too great, tonnage; and in addition it takes up a considerable part of the interior of the hull, which is so necessary for boilers, engines and supplies. Therefore, we make the usual compromises and obtain a partial defense, which guarantees a ship against sinking upon being hit by a torpedo, but which makes it very difficult for her to continue the battle, even if she is not in a dangerous state of inferiority to the enemy.

This is, therefore, the great chance for the torpedo, which has made such progress in the last ten years, to show its offensive superiority against the poor defensive power of the hulls of the dreadnoughts.

Heretofore the torpedo has had three vehicles for bringing it to proper range and for launching it with success, and these are: the torpedo-boat, the destroyer and the submarine.

But all three of these are defective on account of the extraordinary lack of balance between the enormous offensive power of their weapon and their extremely weak defensive power, not only on account of the light plating of the hull, with a few little guns on it, but also on account of their increased size, which makes them easy to see and to hit.

Perhaps the submarine, or the submersible, will be able to reach a greater efficiency in the future if a lighter storage battery is found and if there is invented some new motor that does not have to discharge gas as does the present electric motor, which on this account has such a limited radius of action and such a limited speed. For, if the route of the submarine is shown by the discharge on the surface, the ships with 22 to 28 knots speed will be able to avoid the attacks of a boat limited to running slowly at eight or ten knots, as at present.

Without analyzing the effective improvements in torpedoes or the new inventions that the Commission of Experiments[1] are trying out, which would take us too far from our short argument, we can state with certainty that to-day this arm is almost perfect, on account of its speed, its range, its accuracy and, perhaps, even its offensive power against the net.

Since we do not stop to analyze the weapon, we will not stop to analyze its target, the internal protection of the hull, the use of nets, at anchor or underway, etc.

We wish to show only that the principal reason why this weapon has not yet been able to declare itself, like a gun, is the lack of a swift but well-protected carrier for it.

Attempts of every kind have always been made, as the experts know; and it is useless to record here the *Pietro Micca* and its other successors or to enumerate their faults and defects. None succeeded in establishing themselves, perhaps because the moment was not opportune, as it is now, in this age of dreadnoughts, which are no longer increasing their great displacements; but we do

[1] A permanent board for experiments upon war material.

not think that they will return to the type of the old *Inflexible* and *Duilio*[2] with but four enormous guns.

Nor did these attempts succeed in bringing about the triumph of the torpedo, and this was because it lacked the benefactor who knew how to handle it in a manner practicable enough to cause it to be considered by the experts, who are now so hypnotized by the big guns that they are blind to the weakness of the hulls against torpedoes. How is it possible to launch this new idea?

Let us proceed with a searching analysis. We attempt to bring the torpedo—which must injure, if not sink, the dreadnought—to a reasonable range. Therefore the carrier of the torpedo must be opposed by the small or intermediate guns of the dreadnought, and also, in case of necessity, by the great guns, if these should come into action.

The water is a great aid to defense, but, as we have said, the submarines are slow and must have a discharge to the atmosphere. We seek from the torpedo-boats their good quality, *speed,* and from the submarines their protection, *water;* but in combining these principal factors, we will give the submarine a discharge to the air which will increase its period of offensive action to more than the few hours that an electric motor at full power can give, and we will give to the destroyer a good protection against the small and the large guns of the dreadnoughts.

Two towers armored with about 400-mm. (16-inches) of armor are placed almost at the extreme ends of a ship. Between these two towers are placed the two discharge conduits or stacks, the fresh air for the ship, and all that is inside of it, entering through an armored tube communicating with the outside.

For decreasing the resistance to motion, there is placed, forward of these towers, a cut-water of light plates, so light that they will probably not cause the enemy's shells to detonate. Then astern of the two towers there is another similar cut-water or wedge for the purpose of carrying the stream lines on up so as to keep the eddy water from coming on board. These structures, flared at the top, ought to decrease the pitching in a head sea and the armored towers ought to furnish a good reserve buoyancy for the ship during and after the battle.

[2] The *Inflexible* was an old British battleship with a main battery of four 16-inch guns; the *Duilio* was an old Italian battleship with a main battery of four 17.7-inch guns.

The whole hull is submerged and the upper part is conveniently curved, like the deck of a submarine, and is sloped gradually into the bases of the towers in order to cut down as much as possible the resistance at high velocity in the trials of the model in the tanks. Therefore, in order to reduce the chances of damage to this surface, it is protected with sufficient armor which, in the vicinity of the bases of the towers and in the slopes around them, gradually increases in thickness, little by little, as the efficiency of the protection of the water decreases.

Inside of the hull, the forward part is entirely taken up by six torpedo tubes, three on each side, of the latest, most powerful type; next comes the forward motive apparatus, then another six torpedo tubes amidships, then the after motive apparatus and then six torpedo tubes aft. With each broadside consisting of nine shots, the power of the vessel is very great on account of her ability to prolong the engagement until the complete, or nearly complete, destruction of the enemy's squadron.

As regards stowage space, these weapons and their launching apparatus occupy much less space than does the motive apparatus, which ought to give a speed of over 25 knots.

With a total displacement of eleven thousand tons this special warship has a sufficient margin for mounting eight 152-mm. (6-inch) guns in each of the two towers, for making the destroyers, which could torpedo her, keep their distance, since these are her only dangerous adversaries.

These guns would not be manned in an action against dreadnoughts, this crocodile type having nothing to fear from either the small or the great guns of the dreadnoughts.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

LOSS OF LIFE BY DROWNING IN NAVAL WARFARE[1]

By Surgeon T. W. Richards, U. S. Navy

Losses in personnel, incident to war, fall naturally into various broad but well-defined groups, and these again may be subdivided and classified according to the particular purpose in view. Thus in reports and statistics distinction is commonly made between losses by sickness and casualties in battle, and the latter may be included under such subheads as "Killed," "Wounded," "Drowned," etc.

Under certain circumstances, however, particularly those following a disastrous defeat, details are often wanting, either through actual lack of precise information on the part of the belligerent concerned or disinclination to publish the same. Furthermore, it makes little difference from a military point of view whether a man is killed, captured, or runs away. For these and similar reasons the total loss may be expressed in one item, such as "Killed and Missing," or "Killed and Drowned." Under such circumstances it is not only subsequently impracticable to determine with accuracy the percentage of casualties in any one class, but the actual loss of life as a whole may be largely a matter of conjecture. As will be shown later, the particular class of damage referred to in this paper is especially difficult to estimate with accuracy, and we must rely to a great extent upon methods of approximation.

It will also be obvious that the character, extent, and relative importance of the various losses sustained by belligerents must be vastly modified by a great variety of circumstances, such as the field of war, nature and extent of the campaigns conducted, size, resources, discipline, and experience of the combatant forces, arms and methods of warfare employed, and, especially, *the success or failure of the military operations themselves.* Not only do such

[1] Reprinted from the *United States Naval Medical Bulletin*, Vol. 6, No. 2, April, 1912, by permission of the Navy Department and of the author

conditions influence the damage rates and their distribution during different wars, battles, and minor operations, but they cause great differences from time to time with the same forces in a single campaign. Finally, if we attempt to compare the losses sustained by dissimilar corps or branches of the forces engaged, the above statements apply with additional force.

Thus, in extensive operations on land—particularly if the intervals between battles are prolonged—more men, by far, are lost through sickness than by the direct efforts of the enemy.[2] But as the destructive effects of modern weapons, as actually employed, have not kept pace with the development of medical science and the application of sanitary measures, there is a tendency for this disparity to become less marked. Very recent progress along these lines is indicated by such well-known examples as antityphoid inoculation and the salvarsan treatment of syphilis; one tending to prevent disease, the other lessening its duration and severity.

With respect to casualties, we find that of wounds received by troops in battle a large majority—usually some 75 per cent of the whole number—are inflicted by small-arm projectiles.[3]

	Rifle *Per cent*	Shrapnel *Per cent*	Shell *Per cent*
Officers	71	11	18
Men	79	13	8

As might be anticipated, naval statistics differ from the above in degree somewhat comparable to the dissimilarity between warlike operations afloat and ashore. On shipboard, exposure to morbific influences is not greatly increased by war, while, in general, sanitary measures are quite readily and successfully enforced, so that the damage from illness is relatively less in the navy than among troops ashore.[4] Our casualty lists also differ widely from

[2] "The losses of the Federal Armies in the Civil War in the two years (June, 1861, to June 1863) amounted to 53.2 deaths in the thousand, of which only 8.6 were caused by wounds and 44.6 by sickness." In the short Franco-Prussian War, on the other hand, the relative losses from wounds and sickness were as 34 to 30. (See Bloch: Modern Weapons and Modern Wars.)

[3] Russian statistics from the recent war (Havard and Hoff: Reports of Military Observers. Mil. Inf. Div. Gen. Staff, No. 8, Part II, Russo-Japanese War) are as follows:

[4] In former times sickness on shipboard was, of course, enormously more prevalent, both actually and as compared with other losses, than it has been for many decades.

those of the army: Wounds from small arms are practically *nil,* shrapnel—which is generally more fatal to troops than shell—is seldom used, and we find that nearly all wounds on shipboard are due to great-gun fire, inflicted directly or indirectly by explosive shell.

In these brief generalities I have touched upon only a few of the many conditions which, however much they may differ in character and degree, are nevertheless common to warfare as a whole, affecting more or less *all* the forces actually engaged. There remains, however, a hazard of war which is peculiar to the conduct of warlike operations afloat, namely, *drowning.* It thus affects almost exclusively the *naval* forces, the only material exceptions occurring infrequently in connection with over-sea military expeditions, during the transportation or disembarkation of troops; as examples, we have the sinking of the transports *Kowshing* and *Kinshu Maru.*[5]

"Immediately after the defeat of the Armada, for example, disease and great mortality broke out in English ships and rendered them unfit for action; of a crew of 500 men in a certain ship 200 were swept off within three or four weeks."

"On the occasion of Anson's voyage round the world, there were left at the end of the first year (1740-41), on board the three surviving ships of the squadron, only 335 men out of his total complement of 961; that is to say, two-thirds of his men had perished.

"Blockading squadrons outside of Brest had more than once been put *hors de combat* by disease and had to return home. In the Seven Years' War the navy lost only 1512 seamen and marines in battle, but 133,708 men—that is, 90 times as many—by death from disease and desertions." (A. Steuzel: The British Navy.)

Such records seem almost incredible when we compare conditions of to-day. During 1898 (year of the Spanish-American War) the death rate in our navy from disease was only 4.92, and the percentage of sick (excluding injuries) about 2.44. (See Gatewood: Naval Hygiene, 1909.)

[5] The *Kowshing* was a British steamer chartered by the Chinese in July, 1894, to carry troops to Korea. On the 25th of that month, with 1100 men on board, she encountered four Japanese cruisers. She was hove to and boarded by an officer from the *Naniwa,* commanded by Captain Togo (afterwards commander-in-chief during the Russo-Japanese War). Demand was made that the *Kowshing* surrender, though the vessel flew the British flag and had sailed in peace. The Chinese absolutely refused compliance, though urged to accede by European officers on board. The Japanese returned to their ship, and a few minutes later the *Naniwa* opened fire at a distance of only 200 to 300 yards; she also fired a torpedo.

In peace we ordinarily associate the word "drowning" with accidents involving the death of one or a few individuals, since great naval disasters like the ramming of the *Victoria*—when 358 lives were lost—are exceedingly rare.[6] Even in the merchant marine, such occurrences are exceptional, with the safeguards to navigation in use to-day. When occurring, they are almost always due to collision on the high seas, and appalling loss of life may be aggravated by the horrors of panic among passengers.

To the navy, however, drowning *in warfare* has a far broader significance, implying possibilities of wholesale loss of personnel, which often embraces an entire ship's complement and is invariably incident to total destruction of the vessel itself. As so construed, it has been generally recognized that the questions presented are of grave importance, which has often been expressed in rather loose generalities, and perhaps exaggerations, regarding the extent of the damage so sustained. It seems desirable, therefore, to indicate what this damage has been and to form some estimate of what may reasonably be anticipated in a naval war of the immediate future. To these ends it becomes necessary to examine, briefly, records of the past, and to inquire particularly into the circumstances attending the *sinking* of vessels of war, since as already indicated these will determine practically all the major losses due to submersion. Developments in naval warfare have been so radical within recent years that to obtain data based upon conditions which in any degree approximate those of to-day we must confine our investigation to the era subsequent to our Civil War, which marked the change from wood to steel, from sail to steam. Furthermore, since naval operations tend more and more

---

The *Kowshing* remained afloat for nearly an hour under a pitiless fire, when she slowly sank. At least 700 lives appear to have been lost in this affair.

Somewhat similar circumstances arose when the Russians sank the Japanese transports *Kinshu Maru* (Apr. 25, 1904), and the *Hitachi, Sado,* and *Izumi* (June 15). The total number killed or drowned on the *Hitachi Maru* alone is belived to have been about 1000; reliable statistics for the other vessels are not available, but the loss was much less heavy.

In considering the strictures expressed regarding the sacrifice of life in these operations, the refusal of the troops to surrender when granted the opportunity should be borne in mind.

[6] Even in peace, drowning is usually responsible each year for more deaths in the naval service than any other one cause.

toward concentration of forces, so that actions between individual ships or small units are now relatively unlikely and of lessening importance, it would seem that our attention could be most profitably directed to battles involving squadrons and fleets. While this is true as a general proposition, it will nevertheless appear that there have been a number of individual catastrophes, the records of which are informing, because the attendant circumstances are better perceived than is possible in the case of great fleet engagements, where it is always difficult to form an accurate mental picture of any particular incident in the kaleidoscopic movement.[7]

Within the limitations so imposed there have been several wars, each of which was marked by one or more great naval actions, the more important of these being known as the Battles of Lissa, the Yalu, Manila Bay, Santiago, and the Sea of Japan, more commonly called Tsushima.

The battle of Lissa (June 27, 1866) was fought during the transition period of naval armaments, each belligerent having a heterogeneous fleet, consisting of both wooden and armored vessels. Of the former we need give little account. On the Italian side they took no active part in the battle, but the Austrians handled their old unprotected ships most gallantly, the *Kaiser,* flagship of Commodore Petz, particularly distinguishing herself. She succeeded in ramming the armored *Portogallo* (sister ship of the *Re d'Italia*), delivering a glancing blow fairly amidship, but inflicting less damage than she received herself.[8]

It will be remembered that the Austrian admiral, Tegethoff, engaged (at 10 a. m.) in a **V** formation, with his armoured ships in the van, his tactics throughout the battle being admirably summed up in his celebrated order "Ram everything gray." If the Italians had any plan at all they soon lost sight of it when their admiral, Persano, at the very last moment threw his formation into confusion by stopping the *Re d'Italia* and transferring his

[7] "Le bataille...est, comme toutes les batailles navales, assez difficile a reconstituer, par suit de la disparition des temoins importants ou de l'impossibilité pour une partie des survivants de donner des reseignements precis. Une bataille terrestre s'accroche a certains episodes faciles a ressaisir grace au terrain." (L. G. Laur: Tsushima.)

[8] The casualties on this ship were more than half the entire number suffered by the Austrians, viz., 24 killed and 75 wounded from a total of 38 killed, 176 wounded.

flag, unknown to his subordinates, to another vessel. A long gap was thus formed between the first and second divisions, through which, in the smoke and confusion, the Austrians blundered, to their own surprise and great good fortune of the enemy. The battle now became a *mêlée*. Tegethoff, true to his principles, made several ineffectual attempts to ram with his flagship, the *Ferdinand Max*, a vessel of some 5000 tons, carrying 5-inch armor. Suddenly, about 11.20 a. m., through the thick cloud of smoke, he saw a great gray mass stationary in the water. The order "full speed ahead" was given, and a moment later the prow of the *Max* was driven, without severe shock, through the collapsing decks, frames, and armor of the *Re d'Italia*. "The *Italia* was careened far over to starboard by the impact. Then, as the *Maximillian* withdrew her ram from the deadly wound, the great Italian ship rolled back almost on her beam ends and sank, without righting, bow first beneath the waves, leaving the water strewn with struggling human beings."[9] All accounts of this incident agree in stating that the stricken ship, a vessel of 5700 tons, carrying 7 inches of armor, gave but one roll, sinking as she listed to port—a destruction almost unparalleled in its rapidity.[10]

The *Ferdinand Max* and some Austrian gunboats immediately attempted to lower boats to rescue the drowning crew, but were prevented from so doing by the fire of several Italian ships, probably because in the smoke the latter did not appreciate just what had occurred. The victims of disaster were thus left to their fate, but an extraordinary circumstance, thus recorded by Wilson, prevented their complete annihilation:

> "The survivors of the *Re d'Italia's* men were on the point of drowning, when suddenly there came an upward rush of water, caused perhaps by the explosion of her boilers, which carried to the surface timber and fragments to which the survivors clung.[11]"

This wreckage was not discovered until the action was over, probably more than an hour after the ship sank, when 166 survivors were picked up by the Italians, 400 persons having drowned in the meantime.

[9] Naval Battles in the Nineteenth Century, Rear Admiral F. J. Higginson, U. S. Navy.

[10] The *Victoria* remained afloat 10½ minutes, though many of her watertight doors were open.

[11] Ironclads in Action, H. W. Wilson.

The only other vessel destroyed during this battle was the Italian armored gunboat *Palestro,* 2000 tons. She was set on fire and severely punished early in the action. The flames spread beyond control, and though her magazines were flooded an emergency store of ammunition was overlooked. At 2.30 p. m. she blew up, only 19 of her complement of 230 surviving. In this and many similar instances it is obviously impossible to positively determine the relative numbers of the killed and drowned. Since the destruction of the ship was known to be inevitable—though the explosion was not anticipated—it is reasonable to assume that most of the crew were on deck; and if so, that not more than half the crew were killed outright. In other words, the loss of life was probably twice as great as it would have been had the explosion occurred on land. This difficulty, however, is not insurmountable and will be referred to later.

In reading the records of earlier sea fights one is struck by the relative frequency of occurrences like the above. It might almost be said that the natural end of the old ship of line was due to fire, not water.[12]

From a consideration of all the data available, the following estimate of the Italian losses in this battle appears to be approximately correct:

Killed (by gunfire)	5
Drowned (or killed with sinking vessels)	615

At the Yula[13] all the ships engaged were armored, or at least "protected," vessels of iron or steel, and this battle is said to have been "in a way the most important sea fight since the time of

[12] No vessels were actually sunk during the battles of the Nile and Trafalgar, but on each occasion one or more ships exploded. At Copenhagen most of the Danish ships were taken or burnt. "The *Dannebrog* (flagship) caught fire and blew up after the action." (Wilmot: Our Navy for a Thousand Years.) At Navarino (1825), one of the fiercest naval battles ever fought, the Turks and Egyptians "stood by their vessels till they were wrapped in flames, and they could be seen rushing from point to point about their decks and climbing into the rigging to escape death by fire. But there was no escape; ship after ship blew up and blazed fiercely, making the bay a mass of charred wreckage illuminated by burning hulks." (Higginson.)

As an exception, the *Vengeur* was sunk (Battle of the First of June, 1794), 400 of her crew being rescued by boats from the English fleet.

[13] See Acciones Navales Modernas, por J. de Salas, Teniente de Navio.

Nelson." (Higginson.) It will be unnecessary to go into tactical details of the action in general. The Chinese, under Admiral Ting, approached in line, with their heavier ships in the center, but as the wings consisted of slower vessels the formation was actually crescentic. The Japanese advanced in column, with a fast squadron in the van which swept around the weak Chinese right and attacked from the rear, while the main squadron concentrated on the same position from the front. As has so often happened before and since, the losing side soon became a confused "mob of ships." In addition to their initial tactical advantage, the Japanese fire was far more effective than their enemy's. The latter fired slowly and at random, but their heavier guns caused great execution when a shot did take effect on the unarmored ships of the Japanese.

Considering the damage inflicted on both sides, it seems somewhat surprising to find that only two ships, both Chinese, were actually sunk in action,[14] viz., the unarmored *Chih Yuen,* 2300 tons, and the *King Yuen,* 2850 tons, with 9.4 inches of armor. The *Chih Yuen* was hotly engaged early in the action; after being hit repeatedly she listed heavily to starboard and slowly sank by the bow, going down with all hands. She was destroyed by gunfire alone (a 12-inch shell is said to have finished her career), but a violent explosion occurred as she sank, either due to her boilers or to a torpedo on board (3.30 p. m.).

About 20 minutes after this catastrophe the *King Yuen,* already on fire, received the concentrated fire of the *Yoshino* and *Takachio* and also withstood a hail of projectiles from one ship after another of the flying squadron. She was subsequently seen to be rolling heavily, and at 4.50 p. m. sank, stern first. "Her end is veiled in mystery. All the Chinese who saw her go down attributed her loss to a torpedo, but the Japanese fired none. There was a very thick cloud of smoke and an explosion just before she vanished, like the *Victoria* capsizing and showing her bottom. Of a crew of 270 men only 7 escaped." (Wilson.)

[14] Of course this does not represent all the Chinese ships that were lost. Many suffered greatly from fires, and one, the *Lai Yuen,* literally burned out. The *Yang Wei* is sometimes referred to as having been sunk; she was set on fire and withdrew, later being in collision with the *Tsi Yuen,* and appears then to have been run aground and abandoned. She was torpedoed next day by the Japanese.

The destruction of these two Chinese ships is thus curiously alike. It has been suggested that one or both struck live torpedoes, fired by the Chinese, which may have been floating about in the water, but it is much more probable that in each case sinking was due to gunfire alone.

The Japanese casualties in this fight were, all told, 90 killed and 204 wounded. On the Chinese side the percentage of injuries from gunfire was much smaller (on seven surviving vessels, 36 killed and 88 wounded), owing to their armor protection, but on the ships which were sunk the loss of life is estimated to have been from 600 to 800. The total force on each side was about 3000; as there were only 10 Chinese ships seriously engaged it thus appears that 20 per cent of these vessels were sunk in action and that the loss of life from drowning was proportionately heavy.

Four years after this conflict the two naval battles of our late war were fought, the Spanish ships engaged being captured or destroyed. Although of such peculiar interest to us, there appears to be little data obtainable therefrom which is pertinent to the subject of this paper. This is owing in great part to the very completeness of our success in each engagement. The Spanish fought their ships bravely, but the disparity in strength of the fleets led them to discount disaster beforehand. Thus each battle was fought close inshore, and the ships were grounded or partly sunk in shoal water when their destruction became inevitable. Those in Manila Bay were apparently abandoned without serious difficulty, though precise information is lacking. With the punishment received it would seem that their own boats would have been unserviceable, even for the short trip required. The total loss, as reported by Admiral Montojo, was 381 killed and wounded, probably an underestimate, but this does not appear to include any material loss by drowning, and it seems likely that very little occurred.

At Santiago the situation differed in details. Although all the larger vessels and the destroyer *Furor* were actually beached,[15] all except the *Colon* were blazing furiously, and it seems inevitable that many men were drowned as they were forced overboard by

[15] The destroyer *Pluton* was sunk, but I am unable to find any estimate of her casualties. Probably our vessels rescued many of the crew.

fire. Our own ships were prompt and active in the work of rescue and undoubtedly saved many who would otherwise have lost their lives in attempting to reach the shore. Rear Admiral Higginson, in his description of this battle, accounts for the entire Spanish force as follows: "Thus four beautiful Spanish ships and two destroyers had gone to their death before the overwhelming fire of the American vessels, and of the 2300 Spaniards who entered the conflict, 350 were killed, 200 wounded, 150 escaped by swimming ashore, and 1600 surrendered." Judging from the small proportion of wounded it seems that the "killed" may here include all not otherwise accounted for and that the number drowned will never be known. But in any event, one lesson seems clear: Had these battles been fought on the high seas they must have resulted in early surrender of the Spanish ships or an appalling loss of life, probably proportionately greater than that of any sea fight of modern times.

Coming now to the most recent and greatest of modern wars, we will find in the Russo-Japanese conflict a mass of data which should be particularly informing. Owing to the extent of the naval operations even reference to them all would be quite impracticable within the limits of this paper, but the briefest outlines will serve to connect the following incidents more or less consecutively:

The first vessel sunk with great loss of life was the Russian minelayer *Yenesei*. On February 11, 1904, while engaged in her special work in Tahin Bay, she struck a mine which had just been planted, sinking in less than 20 minutes with 4 officers and 89 men.[16] About a month later the destroyer *Steregushchi* was cut off, disabled and surrounded by the Japanese as she was attempting to re-enter Port Arthur. Although she was in a sinking condition, an effort was made by her captors to tow the boat out,

[16] The *moral* effect of such sudden loss by drowning is well illustrated by an incident which occurred shortly afterwards. When news of the *Yenesei's* destruction reached Port Arthur, the *Boyarin*, with four destroyers, was dispatched to Ta-lien Bay. As she was about to anchor she struck a mine. "All boats were immediately lowered, the ship was abandoned, and the crew was transshipped to the destroyers, which had approached directly the explosion had occurred." The destroyers steamed back to Port Authur, but instead of sinking, the *Boyarin* drifted about the bay for two days, finally going down during a violent gale and snowstorm.

but the line parted. Attempts were then made to rescue the crew, but she sank with all hands except 4 men.

After having made several unsuccessful attempts to bottle up the Russian ships in Port Arthur, Admiral Togo decided to harass this force by dropping mines within the area commonly chosen by the Russians in their maneuvers outside the harbor. This operation, one of the first of the kind ever attempted, was secretly accomplished on the night of April 12, and its extraordinary success resulted in one of the most dramatic incidents of the war. Early the following morning the destroyer *Strashni,* after a 15-minute engagement with two Japanese boats, was sunk off the harbor, 5 men only being saved. Thereupon the Russian ships steamed out, the battleship *Petropavlosk,* flying the flag of Admiral Makaroff, in the lead, and proceeded on their usual course under the batteries. "Suddenly at 9.40 a. m., a loud report was heard, and the eyes of everyone in both fleets were turned on the Russian flagship. She had struck a mine. The first explosion was followed by a second, and that again by a third, a vast cloud of smoke and steam hung over the water, and when it lifted the *Petropavlosk* has disappeared. Of her whole crew only 7 officers and 73 men were picked up, and with her perished the celebrated painter Vereshchagin."[17] It is stated that "all spectators of the disaster . . . . are agreed that the second explosion occurred in the magazine and the third in the boilers."[18]

So far, the damage had been chiefly on the Russian side, but the Japanese did not escape their contributions. In sweeping for mines in Kerr Bay (near Port Arthur) two torpedo-boats were sunk and 8 lives lost. On May 15 a much more serious misfortune occurred, due to the Russians having adopted the methods which had proved so effective against themselves a month earlier; that is, they strewed mines on the high seas off Port Arthur.[19]

[17] British Official History of the Russo-Japanese War, Vol. I.

[18] The Russian troubles on this occasion did not end with this diaster. At 10.15 the *Pobyeda* also struck a mine; though badly injured, she managed to remain afloat and regained the harbor.

[19] These were floating, contact mines, left to drift indefinitely, far and wide. They became a serious menace to neutral vessels, the Chinese being the greatest sufferers. Their delegates at The Hague Conference of 1907 said that: "their Government was still obliged (two years after the war) to furnish its coasting vessels with special instruments to remove and destroy the floating mines which encumber not only the high seas but

About 10 a. m. the Japanese battleships traversed this field, with disastrous consequences. The *Hatsuse* promptly struck a mine which disabled her helm, " and a few minutes later the *Yashima* also struck a mine, or possibly two mines together. When the first explosion occurred preparations were made for taking the *Hatsuse* in tow, but before they could be completed she struck a second mine, which . . . . seems to have exploded one of her magazines. The effect was similar to that on the *Petropavlosk*. An enormous cloud of steam arose and the *Hatsuse* disappeared in about a minute and a half." (British Official History.) Four hundred and ninety-four[20] lives were lost in this catastrophe. The *Yashima* also sank some hours later, after being abandoned, however, by her crew. The loss of this vessel was successfully concealed by the Japanese until some months later.

On the 25th of May the Japanese sustained still further loss, the cruiser *Yoshino* being rammed and sunk by the *Kasuga*. The accident occurred in a dense fog, which prevented the other vessels from rendering much assistance. She sank as some of her boats were being lowered and they were swamped. From a crew of about 400, all told, 335 were drowned. To complete this series of disasters, the destroyer *Akatsuki* was sunk by a mine, with the loss, it is said, of all her officers and 16 men; the rest of the crew were picked up by other boats in the flotilla.

Other Japanese vessels destroyed by mines during 1904 included the coast guard ships *Kaimon* and *Saiyen* and the destroyer *Hayatori*. While the loss of life amounted, in all, to about 90 officers and men, these were minor events, and the list may be concluded with the following serious disasters: On September 18 the gunboat *Haiyen* was engaged in guard duty in Pigeon Bay and about

---

also its own territorial waters...and from five to six hundred Chinese citizens...have suffered a cruel death from these dangerous engines of warfare." (See The Two Peace Conferences, W. H. Hull.) The question as to the use of such mines was the subject of much discussion at this conference, and the rule finally adopted forbids the use of unanchored mines unless so constructed as to become harmless within one hour after their control has been lost. (Article I, Eighth Convention, Second Hague Conference.)

[20] Unless otherwise noted, Japanese statistics are from the Report on the Naval Medical and Sanitary Features of the Russo-Japanese war to the Surgeon General, United States Navy, by Surgeon W. C. Braisted, U. S. Navy.

dusk she struck a mine. She sank at once, her boats being swamped by a heavy sea then running. In spite of assistance from another ship close at hand, only 4 were saved from her completement of 201 officers and men. About three months later the cruiser *Takasago* was lost under somewhat similar circumstances off Port Arthur, 298 lives being lost.[21]

The first great sea fight of the war occurred on August 10, when the Port Arthur fleet endeavored to force a way to Vladivostok. Although this action resulted in the practical elimination of the Russian ships as a fighting force, none were sunk. Six of the larger vessels, badly crippled, returned to Port Arthur, where they were eventually blown up and sunk by the Russians; the rest were beached and abandoned or reached neutral ports, to be interned during the remainder of the war.

Four days later the Vladivostok squadron, consisting of the cruisers *Rossia, Rurik,* and *Gromoboi,* made a sortie, and, meeting the Japanese under Kamimura, a running fight ensued, lasting five hours. The *Rurik,* being too slow to keep up with the others, received the severest punishment and, having been pierced below the water line aft, finally sank by the stern, her whole crew being thrown into the water, as she had no boats intact. The Japanese ships' boats and torpedo-boats promptly came to the rescue and picked up over 600 men, many of whom were badly wounded.[22] This incident is most exceptional, and it is of particular interest as demonstrating the possibility of rescuing practically an entire crew under battle conditions.

With these events naval operations of importance inevitably ceased for the time being, to be resumed with the arrival of Admiral Rodjestvensky's fleet and the Battle of Tsushima, May 27-28, 1905.

The great number of ships engaged in this battle, its extent and duration, and the eventual dispersion of its component units—resulting in several more or less independent secondary engagements—preclude any attempt to give a concise, yet clear and connected, account of the whole series of events. The general details, however, are so familiar that it seems only necessary to summarize the circumstances attending the destruction of certain

[21] Arch. de Med. et Phar. Navales, August, 1911.
[22] T. Cowan: The Russo-Japanese War.

Russian ships, bearing in mind that no Japanese vessel (except torpedo craft) was lost or even seriously damaged.

BATTLESHIPS[23]

Osliabia.—Head of second division. "Was set on fire and sunk by gunfire. Driven out of line in less than 30 minutes after battle began; floated 30 minutes longer."

This vessel was struck by three large projectiles about the water-line. She listed more and more to port, capsizing as she sank. The stability of many of the Russian vessels is said to have been impaired by the excessive amount of coal stowed in every available space, including some of the officers' staterooms; little of this extra supply was used, as that in the bunkers was first drawn upon. Unless a ship capsizes suddenly, it would seem that this event does not necessarily lead to increased loss of life. On the contrary, if the preliminary list is slow and extreme, it might serve to relieve the men below, who would otherwise inevitably be drowned. Some 200 survivors were picked up in this instance by two Russian destroyers, a greater number than is recorded for any other battleship sunk under similar circumstances.

Suvaroff.—Head of first division; flagship of Admiral Rodjestvensky. "Was set on fire before 2.45 p. m. Driven out of line in less than 40 minutes after battle began,[24] floated 4 hours and 40 minutes longer." She was attacked three different times by destroyers and sank at 7.20 p. m.

This ship was naturally selected for concentrated attack and suffered terribly from gunfire before and after she left the line. Semenoff estimated her casualties to be greater than those of the entire Japanese fleet. While this may be an exaggeration, it seems altogether probable that not more than half her complement—over 900—were living at the moment the ship sank. Most, if not all, of these must have drowned. The Admiral and his staff left the ship, and a destroyer was sent to search for her and take off her crew, but she could not be found. If any of her crew were picked up, there seems to be no record thereof.

[23] See Wainwright, Richard, Captain, U. S. Navy, PROCEEDINGS United States Naval Institute, December, 1905. Also *Journal Royal United Service Institution*, September, 1906. Many of the following details are from the article on this battle translated from the *Marine Rundschau* by Captain R. H. Anstruther, Royal Navy.

[24] The Russians opened fire at about 2.08 p. m.

Alexander.—Second of first division. "Set on fire and sunk by gunfire. Driven out of line in less than 40 minutes after battle began." According to Semenoff, she sank at 5.30 p. m.

The *Alexander,* like the *Borodino,* was a sister ship to the *Suvaroff* and received similar punishment. I can find no reference to the fate of her crew. Doubtless there were a number of individual survivors, but no general rescue.

Borodino.—Third of first division. "Set on fire at 6.40 p. m. At 7.23 a serious explosion, probably magazines, took place and she sank instantly. Driven out of line in 4 hours and 30 minutes after battle began; floated 43 minutes longer."

Semenoff was on a destroyer near at hand when she sank. He says: "'Look—the *Borodino!*' was shouted on all sides. I raised myself as quickly as possible on my arms, but where the *Borodino* had been nothing was visible save a patch of white foam." He makes no mention of any attempts at rescue, but the Japanese cruiser *Kasuga* is known to have picked up 40 of her crew.[25] There is no doubt but that these were practically the only survivors.

Sissoi Veliki.—Second in second division. Torpedoed during night of 27th and sank about 10.30 next morning. After working all night to keep her afloat, attempts to construct rafts were being made in the morning "when the *Monomach,* with a heavy list to port, and the destroyer *Iromki* were seen approaching. The *Monomach* would not take the crew on board, as she was expected to go down herself any minute. The destroyer could only take a few, so the captain of the *Sissoi Veliki* refused her help. An hour later three Japanese transports came on the scene and saved 570 men."[26]

[25] Brassey's Annual, 1906.

Vice Admiral De Cuverville states (Les Leçons de la Guerre) that during "the 28th and 29th of May, more than 2000 Russians, officers and sailors, came aboard (the Japanese ships) in boats or were picked up at various places on the coast. Some of them succeeded in going as far as Hamada, a hundred miles from the scene of the action."

[26] "The auxiliary ships *Shimano Maru, Tainau, Maru, Yanata Maru, Sado Maru,* also a certain number of destroyers, had been directed to scour over the field of battle to collect the survivors." (See La Lutte pour l'empire de la mer, par Rene Daveluy, capitaine de frigate.)

This procedure accords with the provisions afterwards incorporated in Article 16, Tenth Convention, Second Hague Conference, 1907, which

Navarin.—Ship received little damage during daylight of 27th. Torpedoed twice during night and twice next day; sank at 2 p. m. of 28th. "The crew remained at their stations until the pipe 'All hands on deck.' The attempt to get the undamaged boats in the water failed . . . . Of the whole crew only three men were saved, two of whom were picked up by a British steamer the following afternoon."

As the casualties on this ship had been comparatively few, practically her entire crew were drowned, the most extreme case of the kind on record.

Admiral Nakimoff.—Fourth in second division. "Torpedoed night of 27th. Sank at 10 a. m., 28th."

The crews of this ship and the *Monomach* were taken aboard the *Sado Maru* and destroyer *Shirani* about 10 minutes before they sank. (De Cuverville.)

COAST-DEFENSE SHIP

Admiral Ouchakoff.—Second in third division. Leaking from hits in action, 27th. Surrounded next day, a Japanese ship flying signal: "We advise you to surrender. Admiral Nebogatoff has given himself up." In answer the *Ouchakoff* opened fire, a council of officers (called by the captain) having unanimously decided to fight to the end. After an hour's fight, began to sink, and captain ordered her valves to be opened and crew to save themselves. Eighty were drowned.

ARMORED CRUISERS

Dmitri Donskoi.—Under heavy fire, 28th, losing in two hours 60 killed and 120 wounded. After this action valves were opened and ship sank in deep water. Crew reached shore or were rescued by *Kasuga.*

---

provides that: "After each engagement the two belligerents shall, so far as military interests permit, take steps to search for the shipwrecked, sick, or wounded, and to insure them, as also the dead, against maltreatment." This article is not found in the convention of 1899, but similar measures are enjoined upon belligerents after battles on land by the Geneva Convention. In view of the inevitably wide dispersion of the units during a great fleet action, the importance of this humanitarian measure is likely to become increasingly obvious.

Vladimir Monomach.—" Torpedoed in the night of 27th. Sank at 10 a. m., 28th." Her crew were taken off with the *Nakimoff's.*

CRUISERS

Svietlana.—Fought to the last, morning of 28th. After an hour's action, with heavy casualties, captain ordered the sea-cocks opened. " He remained on the bridge as the crew jumped overboard; the second in command was killed as he was trying to rescue the wounded. The ship went down in deep water about 11.35, and the Japanese steamed away to chase the *Donskoi.* About 5.30 p. m., 10 officers and 100 men (out of 440) were picked up by the *America Maru,* of whom 22 were wounded men lashed up in their hammocks." These evidences of care and rescue of the wounded are of particular interest.

AUXILIARIES, TRANSPORTS, ETC.

Ural.—Sunk after being abandoned. Crew taken aboard *Anadir.*

Kamtchatka.—Sunk in action about 7 p. m., 27th. Fate of crew uncertain.

Iltis.—Sunk in action, 27th. Fate of crew uncertain.

Angier.—Sunk in action, 27th. Fate of crew uncertain.

Russe.—Sunk in action, 27th. Fate of crew uncertain.

Irtish.—Sunk in action, 27th. Fate of crew uncertain.

Details regarding these ships are not available. Some were sunk quite early, when opportunities for rescue were seldom at hand; so altogether they probably contributed their quota to the list of drowned.

In addition to the above, five destroyers were sunk.[27]

[27] To complete the list of Russian ships the following is appended for reference:

Nicholas.—Surrendered; Nebogatoff's division.

Argol.—Surrendered with Nebogatoff's division. (Fourth ship, first division.)

Seniavine.—Surrendered; Nebogatoff's division.

Apraxine.—Surrendered; Nebogatoff's division.

Izumrud.—Escaped, but sunk on rock in Vladimir Bay.

Almaz.—Escaped to Vladivostok.

Anadir.—Escaped to Diego Suarez.

Korea.—Escaped to Woosung.

In proceeding now to an analysis of the above data, it will be expedient to consider first the statistics on the Japanese side, as these are much more complete and accurate.

The total number of fatal casualties in the Japanese Navy during the entire war, including the drowned, killed, and deaths from wounds, was 1991. Of these, no less than 1399[28]—over 70 per cent—occurred on ships known to have been sunk, three vessels alone (*Hatsuse, Yoshino,* and *Heiyen*) accounting for more than half the whole number. Undoubtedly cases of drowning occurred on other ships, while, on the other hand, many men were killed outright in the explosions following contact with mines. The proportionate number of the latter can never be determined, but from a practical point of view it does not greatly minimize the relative importance of drowning as a damage factor to admit that on a ship going with all hands some lives were snuffed out a moment before her disappearance. Therefore from all facts at present available, I believe it may be reasonably concluded that in the Japanese Navy *drowning caused many more deaths than gunfire* and its fatalities exceeded in number those from all other casualties.

Any estimate of the Russian losses must necessarily be more or less tentative, subject to revision when, if ever, more exact statistics are published. It should be noted, however, that for our present purpose we are less concerned with the actual loss of life than with a determination of the relative importance of the various factors causing the same, and from this point of view the subject is somewhat more approachable. With the data available, there appears to be no satisfactory means of directly determining the number or proportion of deaths from drowning at Tsushima, for instance, but it seems possible to arrive at some definite results by

Svir.—Escaped to Woosung.
Oleg.—Escaped to Manila; Enquist's division.
Aurora.—Escaped to Manila; Enquist's division.
Jemtchug.—Escaped to Manila; Enquist's division.
Kostroma (hospital ship).—Captured, but released.
Orel (hospital ship).—Captured and condemned.

[28] These figures are from the Official Report on the Organization and Operations of the Medical Department of the Japanese Navy during the Russo-Japanese War. Extracts from the above have been translated into French by M. le Dr. Chemin, medicin de premiere classe, but unfortunately had not been published when this paper was originally written. See *Arch. de Med. et Phar. Navales,* August, 1911.

a process of elimination; that is, by estimating, first, the damage from gunfire and other causes.

In the first place it is clear that the Russian loss from wounds was enormously greater—both actually and relatively—than that of their enemy, due primarily to the much better gunnery of the Japanese. This has been estimated by Japanese and British observers as resulting in two hits to one—gun for gun—early in war, and as many as four to one at Tsushima, the Japanese shooting having greatly improved. Consequently some of the ships when finally sunk had been terribly punished already, and their complements may have been reduced more than half by shell, fire, and suffocation, (*i. e., Suvaroff, Borodino, Alexander, Osliabia,* etc.). These cases are in quite a different class from those vessels sunk with explosion, where the two factors causing death acted simultaneously and were practically inseparable. The Japanese lost no ships in action; sinking was more or less an accidental occurrence, menacing the whole crew, and of these disasters the Russians also had their full share. Up to the battle of Tsushima the record is fairly complete, the principal losses in action being as follows:

	Men killed
Variag	31
Battle of Aug. 10	80
Battle of Aug. 14	320
Total [29]	431

During the same period there were lost by the sinking of the—

	Lives lost
Yenesei	93
Petropavlosk	625
Strashni (about)	75
Total	793

Most of the latter may be fairly attributed to drowning, inevitably associated with the submersion of the ships. But making due allowance for contributory causes and adding miscellaneous casualties occurring in minor operations to the 431 noted above, there is still a heavy balance in the list of drowned.

Regarding Tsushima itself, Daveluy says: "Of the 14,200 men who manned the Russian squadron, 6142 became prisoners; 5000 had disappeared." Braisted [30] states that "the number of missing

[29] British Official History. [30] *Loc cit.*

is variously estimated at from 5000 to 8000," while the lowest figures available give the actual loss of life as "about 4000." It seems conservative, therefore, to assume that some 30 per cent of the entire force perished in this engagement.

It has been generally believed that about 20 per cent is an average casualty list to be anticipated from gunfire in naval battles, and that only 4 per cent will be killed outright, though I think this will prove far too low an estimate for any force which suffers defeat. On the other hand, there is probably a *maximum* death roll, seldom to be exceeded, beyond which it might be actually disadvantageous for the victor to inflict further penalty by *gunfire*. This would seem to have occurred when practically all hands above the armored deck had been killed or disabled, the guns put out of action, and the ship herself rendered incapable of escape. At this stage it will generally be more expedient to deliver the final blow by torpedo attack rather than to expend ammunition which might be indispensable elsewhere.

Such a condition of helplessness would inevitably exist on shipboard when the vessel had lost in *killed alone* 25 to 30 per cent of her complement; allowing at this stage only three men wounded to every two killed, we account for about all the crew outside the ammunition passages, engineering department, and other positions below decks.

The fact that the proportion of "killed" to "wounded" rises rapidly as the percentage of total casualties increases does not seem to have been generally appreciated. This is well illustrated by the following (Russian) examples:

	Killed and wounded *Per cent*	Killed *Per cent*	Wounded *Per cent*
Battle of Aug. 10	8	1.3	6.6
Battle of Aug. 14 (all ships)	36	13	23
Battle of Aug. 14 (*Rurik* only)	52	22.5	29.5

The running fight of August 14 was particularly disastrous to the Russians, but their fatalities did not reach 14 per cent. Upon this occasion the *Rurik* suffered much more severely than the other cruisers. Subjected, as we have seen, to terrific gunfire for several hours and finally sunk, her list of killed ran up to an exceptional figure, 22.5 per cent.

Now, there is no doubt but that on some or all the battleships sunk on the 27th this rate was exceeded, perhaps reaching 30 per

cent, and, on the *Suvaroff*, even more. But it is also evident that a large majority of the Russian ships sank, surrendered, or escaped long before they were reduced to the *Rurik's* plight; for example, the three large vessels of Enquist's division, which reached Manila, had only 37 killed, all told. From consideration of these circumstances and those attending the various individual ships in action I am led to believe that the *average* loss by gunfire for the whole fleet may have reached 12 per cent, a very high mortality indeed; it is generally assumed to have been much less.

On nearly all the Russian ships which were seriously engaged fires were frequent and severe. One of the points raised by Admiral Nebogatoff in his own defense and arraignment of Admiral Rodjestvensky referred to the large amount of woodwork which had been retained on board the vessels of the first and second divisions. Nebogatoff having had his own ships stripped before the battle. In view of the well-known experience of the Chinese ships at the Yalu and those of the Spaniards at Santiago, it is certainly remarkable that greater precautions were not observed to prevent these disasters. As a result, the fighting efficiency of the ships was not only hopelessly impaired, but there was much unnecessary loss of life from direct action of fire, exploding ammunition, and, particularly, asphyxiation. In judging the extent of the damage thus inflicted, Semenoff's graphic picture of conditions on the flagship is especially informing. Referring to the time (5.30 p. m.) Admiral Rodjestvensky was leaving this vessel, he says: "The mess deck was in darkness (the electric light had gone out) and was full of suffocating smoke. Hurrying along to find the staff, we called them by name, but received no answers. The silence of the dead reigned in that smoky darkness, and it is probable that all who were in the closed compartments under the armored deck, where the ventilators took smoke instead of air, gradually became suffocated, lost consciousness, and died. The engines had ceased to work. The electric light had given out for want of steam; and no one came up from below. Of the 900 men comprising the complement of the *Suvaroff* it would not be far wrong to say that, at this time, there remained alive only those few who were gathered together in the lower battery and on the windward embrasure." [31]

[31] The Battle of Tsushima, Semenoff, V., Captain, Russian Navy, translated by Lindsay.

As these conditions were reproduced more or less fully on three other battleships, an average of about 100 deaths on each—say 3 per cent of the fleet complement—has been attributed to this cause.

These approximate results may accordingly be summarized as follows:

	Per cent
Killed by gunfire	12
Killed by fire, asphyxiation, etc	3
Drowned	15
Total	30

Drowning, therefore, appears to have caused at least half the mortality, assuming the total loss to have been somewhere near 30 per cent. The total may, in fact, have been somewhat higher, but there seems to be no definite foundation for the impression sometimes expressed that an overwhelming majority of all the deaths were attributable to the above cause. In general terms it may be accepted as certain that there has been a tendency since Lissa and the Yalu for drowning to assume a position of greater *actual* but less *relative* magnitude, due to the increased loss of life from gunfire. The exceptions to this statement, which occurred in the Spanish-American War, were due to special circumstances resulting from the availability of land, which, in some respects, removes the two principal naval engagements from the category of battles *at sea*.

The questions which now present themselves relate to the probability of such extensive losses occurring in future wars and the adoption of methods for their amelioration. It must be admitted that from a humanitarian standpoint the outlook is far from promising. However much naval conditions may change in the ultimate course of time, every great fleet action of the immediate future seems bound to include for the defeated side a certain sequence of events: A few ships may escape; a larger number will be destroyed during the earlier phases of battle; while for the rest, deprived of power for defense or mobility—reduced, in fact, to veritable charnel pits afloat—the alternatives must be surrender or destruction by torpedo attack. It would seem, then, that the only profitable point for discussion concerns the relative number of ships likely to fall within the second class indicated above, *i. e.*, those which sink early in action.

There are some grounds for believing that the number of such disasters is not at present tending to increase. We may practically dismiss the ram as a weapon of offense, since opportunities for its use are now altogether remote and a repetition of the *Re d'Italia's* fate is most unlikely. The gun, on the other hand, has unquestionably far outstripped the development of armor, and the destructive effect of naval ordnance, as exemplified in the all-big-gun ship, is relatively much greater to-day than at the Yalu or even Tsushima. But most of its damage is above the water-line. Immensely destructive to personnel, no doubt, but not necessarily to the immediate life of the ship under fire. Even with 12-inch shells or larger it will take a great many under-water hits to sink a big ship, properly subdivided; and such hits must always form an exceedingly small percentage of the whole.

Conditions with respect to mines and torpedoes are somewhat different. Undoubtedly one of the most interesting and surprising medico-military features of the last war was the great loss of life directly due to floating mines. The results of torpedo attack were, on the contrary, less destructive to life than might have been anticipated; the Japanese, in spite of dash and gallantry, made a very small percentage of hits, and it took a remarkable number of successful shots to sink or even completely disable a large ship. However, we must assume that with the development of these weapons themselves and utilization of the coming submarine of greater habitability and cruising radius, damage from these sources will inevitably increase; and as the injuries so inflicted, unlike those of the gun, affect primarily the flotation of vessels, they may very directly influence the loss by drowning.

On the whole, then, the power of offense tends so enormously to increase that it seems certain that ships will be *put out of action* more promptly than heretofore; but whether or not they will sink more rapidly, is another question. At this point *size* is likely to be the determining factor for with increased displacement there comes not only actual but *relative* increase in resistance, especially against sinking. Further discussion along these lines, however, would involve technical difficulties quite beyond the scope of this paper.

Before leaving the subject of mines and torpedoes it may be noted that loss of life by these weapons would not have exactly the same crippling effect upon the service generally as an *equal number*

of deaths directly due to gunshot, since the latter are particularly limited to men in a special class, viz., those above decks, the engineer's force being practically exempt. Torpedo or mine explosion, if followed by any loss of life whatever, is likely to include nearly the whole crew, and the damage is thus more generally distributed. *So far as it goes*—and the point is somewhat academic—this tends to make the gun more humane than the torpedo or mine, since with a given loss of life it inflicts more damage on the enemy; obviously it would be easier to replace a whole ship's company than to fill a thousand vacancies among officers and guns' crews alone.

Measures designed to prevent loss by drowning include those provided by the ship herself and relief afforded by other vessels. Little is to be expected from the former source. If wooden boats are brought into action they will not only be useless when needed, but a source of danger from fire and splinters beforehand. The Japanese left most of their boats behind; the Russians generally kept theirs on board. It is not surprising, therefore, that Semenoff refers to a blazing heap of wood where 11 boats had been piled up amidships; they had been filled with water before the action, but this soon leaked out through shot holes and there was not one available to take the wounded admiral off his ship.

Metal boats are exempt from fire, but hoisted on deck they merely serve to explode shells which might otherwise have caused no damage. It has been suggested that they be stowed on the gun deck behind armor,[32] but this certainly seems impracticable in numbers.

Individual apparatus—"life preservers" in some form—should be incombustible and incapable of exploding shell or causing splinters, a combination which does not appear to exist. In sufficient numbers they would also encumber the decks. The Russians used cork mattresses for this purpose and with considerable success, particularly in saving the lives of men wounded and helpless, some of whom were floating about for hours before being rescued. "Canvas bands were sewn on these mattresses in such a manner that a man can slip one of them on and be in possession of an ex-

[32] Commander William Hovgaard, Royal Danish Navy: The Fate of the Russian Ships at Tsushima; Jane's Fighting Ships. 1906.

cellent life-preserver."[33] Since mattresses must be carried on board ship anyway, this procedure seems worthy of development, particularly if some method of rendering the materials fireproof can be successfully employed. On the Russian ships they must have added materially to the conflagrations on board, as there are several references to burning hammocks and mattresses.

Turning to outside assistance we may first consider the hospital ship, but difficulties at once appear, both in practical application and under the provisions of international law. In the past they have not been conspicuous upon such occasions. At Tsushima the Russians had two of these vessels, the *Orel* and *Kostroma*. The former, an 8000-ton ship, was fitted out and maintained by the women of France and Russia; each defrayed half the total expense. The *Kostroma*, of 7000 tons, was bought from the North-German Lloyd Steamship Co. and transformed into a hospital ship at Shanghai. (Spear.) Before the battle one or both appear to have taken position far in the van, where they certainly had no business to be. Later, during the approach and earlier phase of the action, they were near the rear and some 1000 yards to starboard of the main column. During the entire afternoon of the 27th they seem to have hung on desperately to the rear of the transports, the safety of which was a constant source of embarrassment to the Russians, most of them being sunk. The hospital ships, therefore, were distinctly within the immediate area of operations. Eventually both were seized by the Japanese, and if they fulfilled any useful purpose in the meantime I can find no mention of the fact. The *Kostroma* was soon released and proceeded to Vladivostok, but the case of the *Orel* came before the prize court of Sasebo and she was condemned as good prize on four counts, one of which was that, as above noted, she had navigated at the head of the column "*in the position usually occupied by reconnoitering ships.*"[34]

As for the Japanese, "their hospital ships *Saiko, Maru* and *Kobe Maru* were on the Korean coast and did not arrive in time to take an active part in the battle." (Braisted.) As they were well aware long beforehand that a battle was impending, this seems

[33] Spear, R., Surgeon, U. S. Navy: Report to the Surgeon General, United States Navy. 1906.

[34] See A. Pearce Higgins: Hospital Ships and the Carriage of Passengers and Crews of Destroyed Prizes. *Law Quarterly Review,* October, 1910.

to have been in accordance with a predetermined policy not to have such ships within the combatant area, a policy based, in part, perhaps, upon questions of neutrality.[35]

Upon at least one other important occasion a so-called " hospital ship," or at least a vessel more or less set aside for hospital purposes, was within reach during a naval battle, and this was as far back as Lissa.[36] She remained with Admiral Albini's division, taking no part in the day's proceedings, though she seems to have received the wounded from a landing force previously sent ashore. It is of interest to note that she mounted two guns, which was of course entirely permissible, as such vessels were not then neutralized. Her presence at Lissa is worthy of note, because, as has often been stated, the " needless loss of life by drowning " which occurred during this engagement was largely responsible for the public agitation in favor of applying to naval warfare the immunities which had already, in 1864, been adopted for hospital service on land. Without in any degree minimizing the exceeding importance of these humanitarian rules (which finally became operative at The Hague in 1899), it may be suggested that their application upon this particular occasion would have made no material difference whatever. The *Italia* sank in the thick of the fight where no immediate rescue was possible, while the captain and crew of the *Palestro* gallantly refused to leave their ship, though there was ample opportunity to do so.

Past experience with hospital ships in battle is thus altogether negative, but there are certain well-defined principles which, in the main, will guide their action. For a discussion of these questions in full, Surgeon Pleadwell's paper must be referred to, but certain points may be touched upon in this connection. Regarding the position of the ship, all will agree with Surgeon General Stokes in saying that " it is certain that it would be folly to sacrifice it by placing it within flag-signal distance—in fact, anywhere within

[35] See Pleadwell, F. L., Surgeon, U. S. Navy: The Tenth Convention of the Second Hague Conference of 1907 and its Relation to the Evacuation of the Wounded in Naval Warfare. War College lecture, 1910. *Nav. Med. Bull.*, October., 1911-January., 1912. The whole question of the utilization of hospital ships during and after battle is here elaborately and most ably discussed.

[36] See Wilson, *op. cit.*. Of course, there are earlier examples, such as those in our Civil War. Most of these, however, operated with the army.

the danger zone."[37] When we consider how very extensive this "danger zone" may be, even before there is general dispersion of the ships and squadrons, it will be seen that this is a serious restriction. The area embraced by the guns of a modern fleet is hard to realize; 48 armored ships, in column, without necessary scouts, destroyers, and auxiliaries, could actually sweep at least *500 square miles,* and it is safe to assume that with two such fleets dispersed, in action, the "danger zone" will greatly exceed ten times this area. There are, nevertheless, certain circumstances which might readily arise, as the Surgeon General has elsewhere shown,[38] under which the services of a hospital ship might be utilized to save a crew from drowning, providing communication could be effected under battle conditions up to some 10 or 12 miles. The case of the *Suvaroff* may serve as an illustration. For some time before she sank this vessel was almost completely *hors de combat,* on fire, desperately battered, and at times more or less isolated. It is certainly conceivable that, with the shifting scene of battle, a hospital ship—let us say the *Kostroma*—could have approached and taken off the remainder of her crew, all of whom were actually drowned because the ship herself could not be located. Suppose, however, the *Kostroma* has successfully made such an attempt, questions relating to her neutrality, which are of great practical importance, at once suggest themselves. To be clearly within her neutral rights it must appear that she is not being used "for any military purpose," that she "in no wise hampers the movements of the combatants," and she must act at her "own risk and peril." If, under these conditions, she picks up men actually struggling in the water, the case is plain enough. The Russian program for the First Hague Conference specifically invited action looking to the "neutralization of ships and boats employed in saving drowning sailors *during* or after naval battles," and the phraseology actually adopted—and still in force—states that hospital ships "shall afford relief and assistance to the sick, wounded, and *shipwrecked.*" (Italics are mine.) But at 6 p. m., for example, were the uninjured members of the *Suvaroff's* crew "shipwrecked" (*naufragés* in the original text; the translation has caused some confusion, but it is made clear in the general report)? Professor

[37] See Surgeon Charles F. Stokes, U. S. Navy: The Hospital Ship as an Aid to Fleet Efficiency. *The Military Surgeon,* January, 1910.

[38] Naval Surgery in *American Practice of Surgery,* 1911.

Hull defines this term as embracing "those who have been placed in danger of drowning as a result of a naval combat," and certainly no more accurate definition could be given regarding the plight of the *Suvaroff's* survivors at the time specified above. In any particular case it would therefore seem that the point to be determined is not so much one of principle as one of fact. Was or was not the ship actually *hors de combat* and sinking? If there were any doubt upon this point, the case would probably come before a prize court for decision, but to me it seems quite unnecessary to take the ground, apparently advocated in some quarters, that we must stand idly by until a ship has sunk, struck her colors, or "the battle is over"—a point difficult to determine. According to Admiral Togo, Tsushima was *won* in less than 40 minutes, but for some ships the real fighting had not then begun and was not *over* until the next day.

To continue with our hypothetical case of the *Suvaroff's* crew, now safely transferred to the *Kostroma*: What, let us ask, may be done with them? Sick or wounded men may be retained on a hospital ship until cured—subject, of course, to capture by the enemy—and may then serve again in arms. There is no time limit whatever on their detention except that due to their own physical disability. The men on the *Kostroma*—some or all—are "fit for duty." Can she accordingly during the night discharge these "patients" to the *Ouchakoff* to fill up vacancies for her fight the next day? In such an extreme case the verdict of a prize court would doubtless be "no," as it would certainly be using the hospital ship for a very important and direct "military purpose." It is important to note that such cases are by no means improbable and that they may be on the border line where, in the absence of precedents, no hard and fast rule seems applicable. So far as I am aware this particular source of possible embarrassment has not been the subject of legal discussion.

Without going into further details regarding the function of hospital ships in action, we may safely assume that although upon occasion they may reach a ship which has fallen out of the line and so succeed in rescuing her crew, such opportunities must always be looked upon as too exceptional to answer the problem of drowning.

I therefore wish to invite particular attention to certain supplementary measures suggested to me by some observations made a

few years ago in a paper by Rear Admiral Sir Charles Campbell, R. N.[30] He expresses an opinion that with each squadron of six battleships there should be one hospital ship and an accompanying *sea-going tender*. The latter—two to each fleet—are, in action assigned to positions only one mile astern of the rear vessel in column, the hospital ships themselves being some miles farther away. The writer did not indicate the structural features of these tenders or his views as to their particular utility, but it would certainly seem that small converted yachts, such as those purchased for our navy during the Spanish War, would be admirably adapted to carry out the special work now under discussion. These small craft would require no elaborate medical equipment, and would carry only a small personnel; they should be neutralized, like their parent ship, and their special mission in battle should be to render assistance to crews "placed in danger of drowning." They should, of course, carry "wireless," have as high speed as practicable, and, in addition to life-boats, should be equipped with special life-saving apparatus designed for taking men rapidly on board *directly from the water*, such as two or more booms on each side, rigged with numerous ladders and foot ropes. To this end the vessels must not be too large or their freeboard too high; they must be easily handled, capable of going alongside a battleship if necessary or proceeding directly within the midst of a crew struggling in the water. Vessels of this type could be expected to take some risks. They must not, of course, embarrass the actions of either belligerent or invite inevitable destruction by wilful exposure to direct gunfire; but they need not be guarded with that assiduity which prevents the hospital ship, except on rare occasions, from rendering aid where it is often most imperatively demanded. If the hospital tender came by chance or necessity temporarily within the danger zone her small size would minimize the likelihood of a disastrous hit.

One obvious objection to the employment of such vessels may be based on their small carrying capacity. While I have no positive data available, this question could readily be settled by direct experiment and the necessary displacement determined accordingly. I am convinced that the size should be kept at the minimum and that two vessels, say, of 500 tons each would prove much more

[30] The Organization of a Modern Fleet for War. *Journal Royal United Service Institution*, December, 1906.

useful than one double this displacement. Taking the *Hist*, 475 tons, as a type, it seems probable that some 500 men could in fair weather be crowded on board and retained simply long enough to reach the hospital ship, perhaps 10 or 15 miles away. This is far from the full complement of a battleship, it is true, but it must be remembered that the tender will not be dealing with full complements. Even this number could be taken off a sinking ship only under the most favorable circumstances, with plenty of time available. For example, the ship may be on fire, so that the tender cannot approach on the lee side, conditions which actually existed when Admiral Rodjestvensky left the *Souvaroff*. If the ship has already sunk, it is quite improbable that anywhere near 500 survivors will still be afloat when the hospital tender arrives on the scene, even if her approach requires but a few minutes. On the whole, I would tentatively suggest 900 tons as a *maximum* displacement. That such small vessels can do excellent work along these lines has been already demonstrated by the successful utilization of *destroyers* for just this purpose. But in general their cooperation is not to be counted upon; theirs is a different mission, and they may not be diverted to secondary aims.

Finally, if vessels of the type herein proposed prove actually capable of successful accomplishment in a humanitarian field now so barren of results, I would suggest that they should especially commend themselves to the Red Cross and other charitable associations by reason of their availability and small comparative cost.

In closing this paper the following conclusions are submitted:

1. Drowning in naval warface causes loss of life substantially equivalent to that due to gunfire, or may even exceed it.

2. Unless special means of relief are adopted there is no immediate prospect that such losses will materially decrease.

3. This loss of life is not usually necessary for military ends.

4. Life-saving devices on vessels of war must at present continue to be totally inadequate.

5. That it is desirable to investigate the possibilities of hospital tenders or such other methods as give promise of practical utility.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

EMERGENCY REPAIRS TO A DESTROYER

By Lieutenant Commander J. F. Hellweg, U. S. Navy

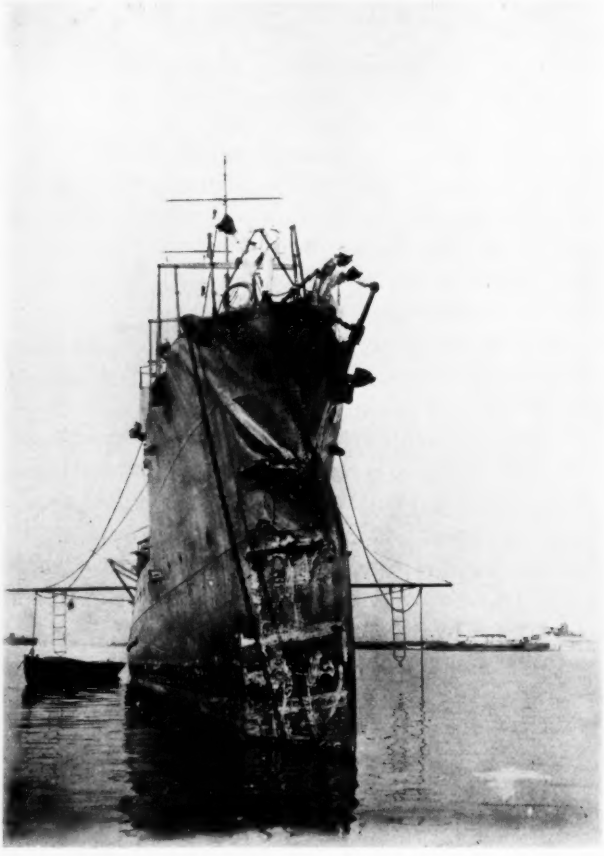
Last winter during the maneuvers off the Cuban coast, the U. S. S. *Burrows* had her bow twisted to port about 80 degrees and badly crushed in a collision. The extent of the damage is shown in photograph No. 1, which shows the sharp twist the stem received and how the starboard plating was torn by the blow. The port plating was so badly crushed and distorted that it had to be cut off and discarded. The bow was undercut by the blow and the forecastle deck was pulled down and to starboard by the sharp twist to the stem.

At the time of the injury the *Burrows* was about 20 or 25 miles off shore and, owing to the twist of the bow to port, was able to make only about 6 knots through the water without risk of straining things forward.

This injury, while not endangering the safety of the ship, effectively prevented the *Burrows* from taking any further part in the fleet maneuvers. Had such an injury been received during war time, the ship could not have operated with the flotilla; and had she been chased, she could not have escaped, as her speed was practically killed.

The return to Guantanamo Bay was so slow that there was ample time to decide how the repairs could best be made; and by the time the *Burrows* anchored, plans were ready to submit to the flotilla commander. The scheme originally submitted on the night of the accident was changed from time to time as circumstances necessitated, or as better ways presented themselves. Many suggestions were offered, particularly by the men working on the job; and as there were no precedents to follow, this being the first known case where such a job was undertaken by a ship's company, all valuable suggestions were quickly seized and incorporated in the general plan.

On the morning following the accident, the *Burrows* was laid alongside the dock at Toro Cay, under her own steam, and the transfer of all weights aft was commenced. A lighter received the anchors and cables on the off-dock side. The anchors and cables were then piled on the quarter-deck on top of the quadrant, a

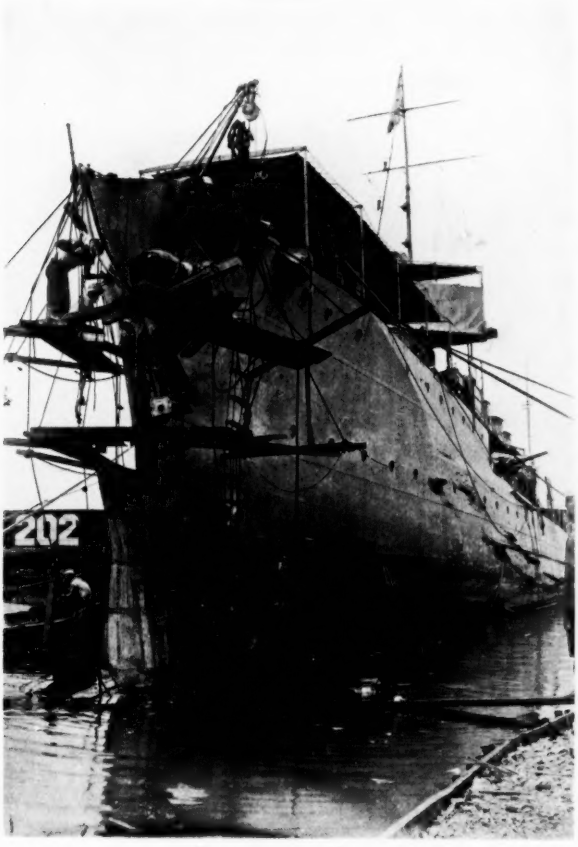


PHOTOGRAPH NO. 1

large patent anchor found on the dock was laid on top of the pile, and all ammunition, oil, stores, water, etc., were transferred aft in an effort to raise the bow sufficiently to reach the break in the keel just abaft its scarf to the stem.

At the same time, stagings were swung over the bow and the work of cutting out the rivets from the stem was commenced.

The U. S. S. *Dixie* provided sufficient 1¼-inch piping to run an air-line from the small Westinghouse compressor in the fire-room up on the forecastle, where it was rigged with three outlets for air tools as shown in photograph No. 2. The small air-line can be seen outside of everything, coming from under the 3-inch gun and



PHOTOGRAPH NO. 2

running up to a position just forward of the second stanchion on the forecastle. Photograph No. 2 was taken after the ship had been taken to Hospital Cay and the port bow plating had been cut off as far aft as the third frame. It will be noticed that the starboard lower plating has been retained, and that on both sides the upper plating remains. The twist of the stem is shown

plainly by the edges of the top plating, the stem having been removed for straightening. The starboard lower plating is shown being hauled back into its proper position by wire straps rove through the rivet holes and hooked to tackles led on the dock.

Air tools were borrowed from the ships in the fleet, and a repair station was rigged on the forecastle to keep the air tools repaired. By afternoon all the gear was rigged and the use of hand tools was abandoned. The work progressed very much more satisfactorily and, by night time, about 50 per cent of the rivets had been

PHOTOGRAPH NO. 3

cut out from the stem. As the bow could not be raised sufficiently to reach the break in the keel, it was decided, upon the suggestion of Chief Boatswain Spicer of the Naval Station, to take the *Burrows* to Hospital Cay the next morning and run her bow up on the small marine railway sufficiently far to enable it to be reached.

The next morning, March 7, 1913, the *Burrows* was towed to Hospital Cay and laid alongside two coal barges placed there for her. Quarter-lines were run out to the dock on both sides, using heavy lines. The *Dixie's* steam launches and motor sailing launches then swung her stern off shore and assisted to point the

Burrows true on the marine railway. Both quarter-lines were shortened in and kept as taut as possible, bow-lines were led out to steady her forward, and a hauling line was led to a winch on the dock. When all was ready, she was landed on the cradle with small trouble and the bow was hauled up just far enough

PHOTOGRAPH NO. 4

to reach the break at low water. Two anchors were borrowed from shore and planted broad off the quarters with 8-inch lines led to the quarter-bitts on both sides to steady her against the tide. Two other lines were led from the quarters to the coal dock on one side and to a barge on the other to steady her. Bow-lines and springs were also led out as shown in photograph No. 3,

which was taken shortly after the *Burrows* was secured in position.

Scaffolding was then built up around the bow, using target-raft material, the men were divided into shifts, and the work was pushed as rapidly as possible. By afternoon, the scaffolding was completed, and early the next morning the stem had been entirely cut out and had been dropped overboard. It was hauled up on the beach, where, owing to lack of facilities, it had to be heated by sections and hammered straight by hand. The straightening of the stem was a tedious job, as only a very short length could be heated and straightened at a time; but the manner in which this job was performed, the practical make-shifts improvised by the men, and the excellent results of their labors, are a tribute to the ability and the ingenuity of the American bluejacket.

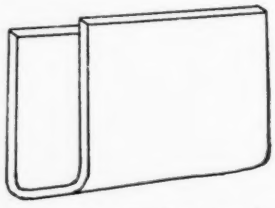


FIG. 1.—Boiler Iron Shoe for securing together the two parts of the broken keel just abaft the scarf of the keel. The holes for bolts were drilled in place.

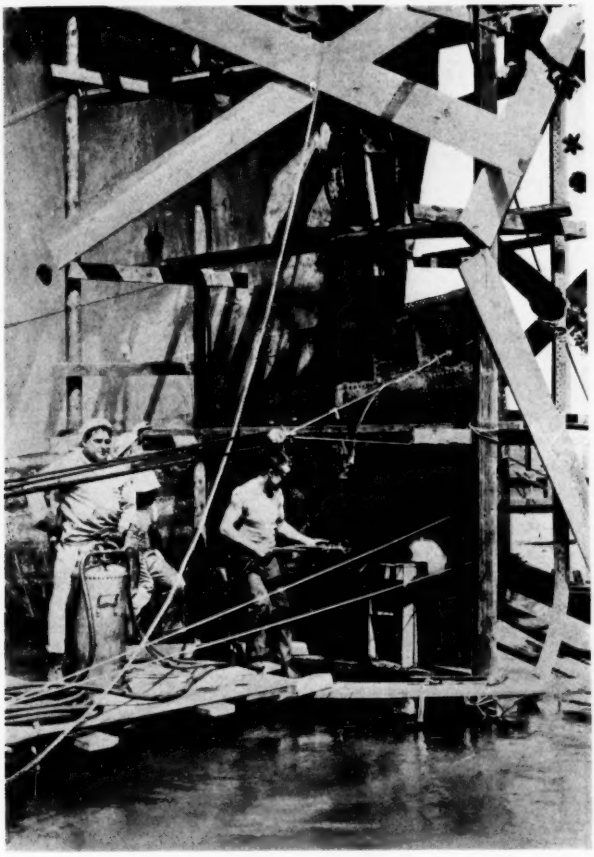
Photograph No. 4 shows another view of this stage of the repairs and also shows the sharp angle at which the forecastle deck was pulled down by the stem. In the foreground a piece of the port side plating is seen lying on the ground.

The wrench of the collision acting on the stem had broken off the keel about two feet abaft of the scarf. When the stem was being straightened, the ragged face of the broken section of the keel was cut off square. A shoe made of ⅜-inch boiler iron (Fig. 1) was fitted snugly over the break in the keel after the stem was swung into its proper position, and was secured by eight large through bolts.

Photograph No. 5 shows the method used in straightening the starboard lower plating. Wire straps were rove through the stem rivet holes in the plating, and tackles were led to the beach, hauling the plating over to its original position. A large blow

torch was borrowed from the *Dixie* and was used as seen in the photograph.

In addition to hauling the plating back into position by the tackles, the following scheme was used to straighten the plates: Holes were drilled at intervals, and heavy bars were placed on both sides with through-bolts passing through the bars and holes in the

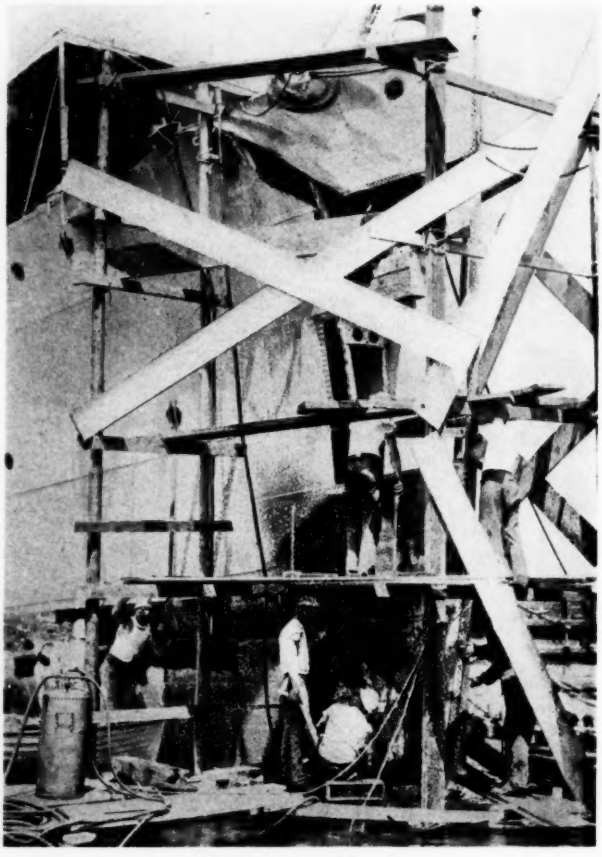


PHOTOGRAPH NO. 5

plating. By setting up on the nuts on the bolts, the plating was forced back straight. The plating was heated and hammered in wake of the bars. In the right-hand side of photograph No. 5 is seen the stem in place (marked *).

Owing to the pull-down on the deck by the stem when it was twisted to port, the forecastle deck was given a sharp pull downward and a twist to starboard. In doing this, the side plating up close to the deck was bulged out, forming two long wrinkles.

After straightening the stem and returning it to its place, it projected above the deck about fourteen inches. To leave it in



PHOTOGRAPH No. 6

that position was out of the question, but the time to effect repairs was limited. An attempt to straighten up the deck was unsuccessful.

The two wrinkles in the side plating were then slit as shown in photograph No. 6; a small wire strap was rove through rivet

holes in the side plating; and, by means of a whip led to the anchor engine, the deck was hauled up to its original position. At the same time two jacks were used below, well supported from the keel, to follow up the deck as it was raised.

The ship's frames were so badly mangled that they were useless and had to be thrown on the beach. Insufficient time was available to attempt making new frames, therefore the following makeshift was resorted to. Breast hooks and stringers of oak were made by the *Dixie* while the above work was being done. The accompanying sketch shows one of the breast hooks. The stringers were plain timbers 7 by 5 inches in section and about 8 feet long. They were fitted in alternately with the breast hooks as shown in

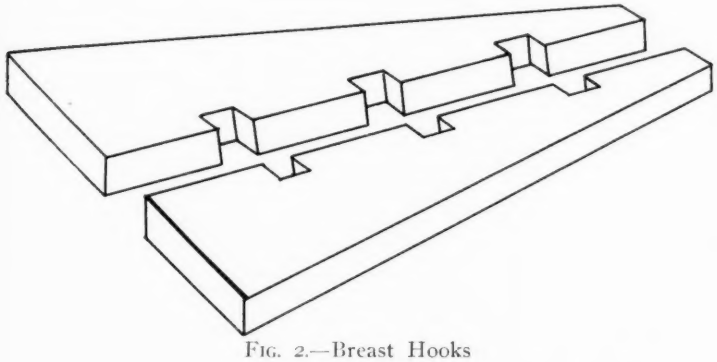


FIG. 2.—Breast Hooks

the sketch, and were wedged between the stem and the frame against which they butted by small wedges driven in place.

The breast hooks were made of 3-inch oak and varied from 5 to 7 feet in length, depending on their location above the keel.

The starboard plating was rivetted in place as shown in photograph No. 7. The port plating was then gradually built up. The breast hooks were fitted in place snugly and then were wedged apart by driving small wedges between the two halves of each breast hook. This made them jam against the skin of the ship. Cement was then poured in through the filling holes shown in the breast hooks, filling up flush with them. Three-quarter-inch bolts were then run through the ship from side to side and were drawn up tight, jamming the whole. The breast hooks rested on these through bolts, three of which were run through the ship

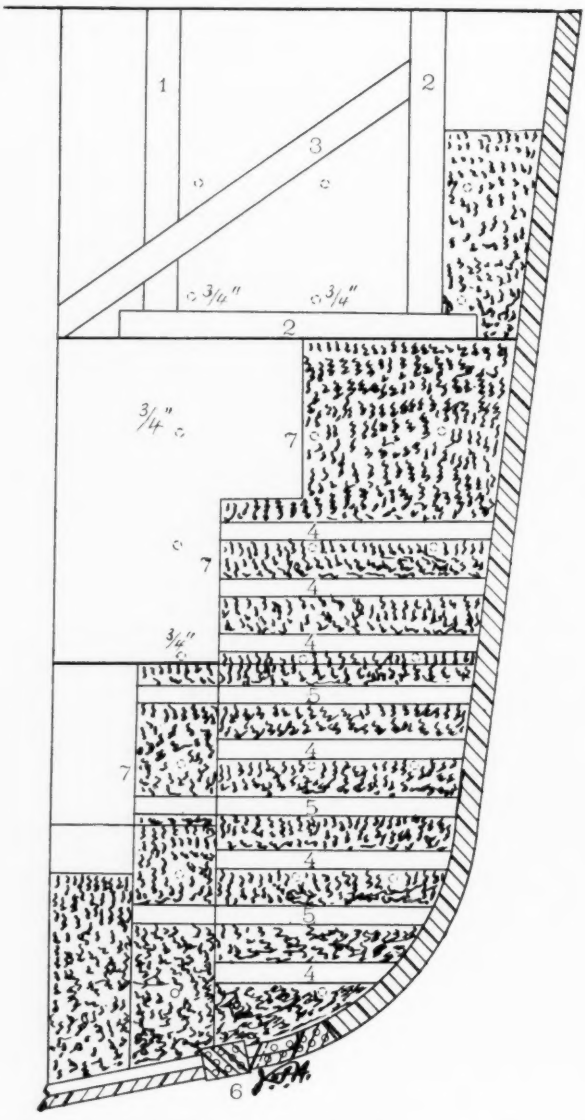


FIG. 3.—(1) Oak shore. (2) Yellow pine shores. (3) Two oak diagonal braces, heeled against W. T. bulkhead out near sides and jammed against shore 2. (4) Oak breast hooks installed as described. (5) Oak stringers. (6) Boiler iron shoe covering break in keel just abaft the scarf of keel. (7) Wooden bulkheads run up to hold cement when pouring around stringers and breast hooks. Coke was used with the cement above the third breast hook.

under each breast hook. The breast hooks were carried aft as far as the third frame, while the stringers, which alternated with the breast hooks and were equally spaced in building up the bow, ran aft as far as frame No. 4.

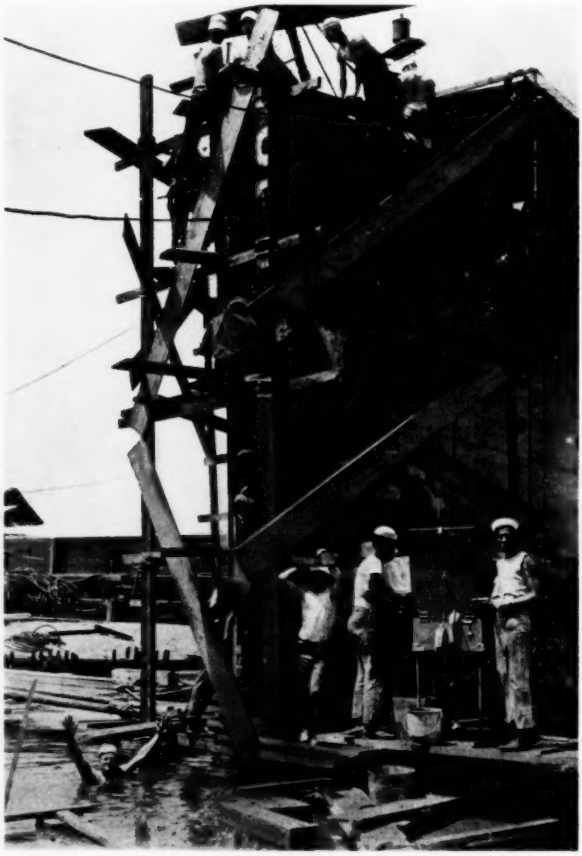
Coke was used in the cement to help lighten the final load.

PHOTOGRAPH NO. 7

Compartment A-1, the forward trimming tank, was filled flush to the deck.

Compartment A-14, lower, was fitted with a light wooden bulkhead, forward of which the compartment was filled with cement and coke.

The through bolts, mentioned above, of which there were 24, were set up with washers and nuts on the outside of the plating, and were then cut off and headed over. Photograph No. 9 shows the bolts plainly and also shows the boiler iron shoe just at the water's edge.



PHOTOGRAPH NO. 8

Photograph No. 7 shows all the starboard plating in position, and the lower half finished rivetting. A portable forge was rigged on the staging built over the water for the lower rivetting, and another forge was mounted on the forecastle for the upper rivetting. Photograph No. 8 shows the port plating partly in

position, the lower and the upper forges, and also the depth of water in which the men had to work. Note the man in the water, showing head and shoulders above water. The blacksmith from the *Monaghan* and the coppersmith from the *Burrows* worked for hours at a stretch under this handicap. This photograph also

PHOTOGRAPH NO. 9

shows the mercury lights swung on the forecastle. These were borrowed from the *Dixie,* and in addition, the ship's search-light was dismounted, carried on shore and mounted so as to throw its light on the bow. When the rivetting began, we kept working till late every night and made very rapid progress.

During these night shifts, the men were provided with hot frankfurters, coffee, bread, and smoking materials; they made a regular picnic of the night work, laughing and talking, and not a single growl or complaint at the hard work and long hours was heard throughout the week's work.

Owing to a scarcity of rivets, it became necessary to drive in wooden plugs in many of the rivet holes, only enough rivets being driven in each plate to insure safety, the balance being plugged with soft wooden plugs.

The new plating used to build up the port side, to replace the useless port plating, was provided by the *Dixie*, and the holes were punched on the beach alongside the ship, using the gear provided by the *Dixie*.

Photograph No. 3 shows how the ship was lying during these repairs. Owing to this position and to her arrangement of stores, etc., she was very easily rolled off her bottom and the west passage had to be closed to traffic during the week we were at Hospital Cay, as one of the battleships' picket launches caused a good deal of anxiety by passing close under the stern at high speed, resulting in the stem fouling the staging and scaffolding, thereby delaying the work till repairs were effected.

Photograph No. 9 shows the starboard side just before backing off. On close examination, the wooden plugs in rivet holes can be seen, the 24 through-bolts, and also the boiler iron shoe which repaired the broken keel. If this be compared with photograph No. 1, an idea of what was accomplished in seven days can be obtained.

No photographs could be taken below decks showing the system of shores used under the forecastle deck, but the sketch (Fig. 3) gives a clear idea of this.

The collision occurred on the afternoon of March 5, 1913. The ship went to Toro Cay the next morning, and was towed to Hospital Cay on the morning of March 7. She was again afloat on the afternoon of March 14, 1913, had oiled ship and was ready for sea that evening. In 91 working hours, the bow had been cut off and rebuilt.

During the maneuvers the next day, the *Burrows* ran at 20 knots and sometimes as high as 25 knots into the frequently-encountered heavy seas off Guantanamo Bay entrance and to the

eastward. This was done without the slightest inconvenience, and everything remained tight.

A month later, the *Burrows* entered the quarterly speed run and maintained her usual high speed.

The men of the *Burrows*, *Monaghan*, and *Dixie* cannot be too highly spoken of for this unusual piece of work, not only for their cheerfulness, but for their ability, their ingenuity in rigging various makeshifts to accomplish results, and their accurate and expeditious work—work which, had it been accomplished during war time, would have attracted the attention of the people in the entire country and would have won their thanks for the men.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

FUEL OILS: THEIR ORIGIN, PRODUCTION AND TREATMENT

Adapted from lectures delivered in the Post Graduate Department of the U. S. Naval Academy in February, 1913,

By DR. DAVID T. DAY, of the U. S. Geological Survey

SYNOPSIS

CHAPTER I. THE CONDITIONS OF OCCURRENCE OF PETROLEUM.

a. The Nature of Petroleum.
b. Theories of Origin of Petroleum.
c. Accumulation of Oil in Pools.
d. Natural Gas and Oil.
e. Accumulation of Asphaltic Oils.
f. Prospecting for Oil.
g. Geographical Distribution of Oils.

CHAPTER II. THE PRODUCTION OF OIL.

h. The Present Oil Supply.
i. Oil Well Drilling.
j. Oil Pipe Lines.
k. East Coast Oil Supply.

CHAPTER III. THE TREATMENT OF OILS.

l. Early Methods of Treatment.
m. Advent of Texas Fuel Oil.
n. Potential Yield of Treated Oils.
o. What are Fuel Oils?
p. Oils for Internal Combustion Engines.

CHAPTER I

THE CONDITIONS OF OCCURRENCE OF PETROLEUM

A. THE NATURE OF PETROLEUM

It seems most important to any adequate idea of the oil industry to begin with some clear idea of what this material petroleum is. Of its very many interesting characteristics there are few which

are important. Much of what is to follow depends upon clearly understanding the relations of these characteristics to each other; therefore, it is necessary to become familiar with them at the outset.

Consider four specimens of crude petroleum. One is black and very viscous; its odor is peculiarly unpleasant. Another is black and very limpid; its odor is like the first. A third oil is thick, but with no bad odor. The fourth is limpid, light in color, and with markedly different odor—not at all disagreeable.

The first oil contains much asphalt, a relatively large amount of sulphur—four per cent—it contains some water mechanically mixed and difficult of separation. Further, it is made up of about all the kinds of oil that are ever found in crude petroleum, and, if distilled, a considerable percentage is left as coke. The second, lighter oil, contains no asphalt, much less sulphur, no water, and by no means so many different oils. The third is like the first, but without the sulphur, while the fourth lacks many of the oils found in the others, contains a larger proportion of gasoline, kerosene, and paraffin wax; on distillation it leaves almost no coke. Let us now see whether we must regard these differences as merely accidental or whether there may be any relationship between them.

So far we have dealt simply with facts, but it is an easy and valuable idea that the simpler oils may be related to the more complex ones—that the heavy oils have, by some natural process, lost their asphalt and sulphur, leaving the simpler oils—that, in general, these complex oils are the mother substances from which the others have been filtered. But the moment one leaves the actual facts and begins to speculate, one finds advocates of other theories; for example, that air has oxidized the light simple oils, and formed the thicker ones.

Recent scientific work has made it valuable to consider that the thicker oils *are* mother oils and have lost their asphalt and sulphur while passing from one place to another within the earth. This idea is strengthened by the fact that the first two oils mentioned are obtained from two different layers only 30 feet apart in the same well in a new field in Mexico. The third oil comes from California. The fourth is from Pennsylvania. One reason why it is unlikely that the asphaltic oils have been formed by oxidation and evaporation of simpler oils, is that they frequently contain

hydrogen sulphide, and this would have been first to oxidize or evaporate.

The thought arises—can we classify all our oils by the regions from which they come; will the four oils mentioned serve as types according to which all oils may be classified? In general they will so serve. It is true that a representative set of the crude oils of the United States alone includes over two thousand distinct kinds. Nevertheless, the differences between these oils are slight and of no great importance in the study of fuel values.

We will have a sufficiently accurate idea of the distribution of oils, therefore, if we think of Mexico as characterized by very viscous oils, rich in sulphur and asphalt, and containing in some proportion practically everything that is known to crude oil. There are many minor exceptions in Mexico, such as the light oil shown, but they are not of present interest.

The Gulf Coast and California oils contain less sulphur and will stand the destructive effect of heat better.

Northern Texas, Louisiana, Oklahoma, Kansas, Colorado, Wyoming, and the states farther east yield lighter oils generally free from asphalt, with very little sulphur and containing unusually large percentages of gasoline and kerosene. An exception is the oil of Indiana and Northwestern Ohio, which contains sulphur, not in so large an amount as in Mexico or as in the oils of the Gulf Coast, but in a form of combination with the oil which offers great difficulty to the removal of the sulphur.

The oils of the asphaltic division contain some oils of the same general character as those obtained in tar from the distillation of coal, benzol, and its homologues. They contain also many oils differing from these by having an addition of all the hydrogen they can receive without breaking up the molecule characteristic of the series. These are naphthenes. It is important for present consideration to recall that ethylene and perhaps acetylene hydro-carbons also are important constituents of these asphaltic oils. This fact is important because the behavior of the oils on being heated is largely due to the presence of these hydrocarbons. If these oils are sufficiently treated with hydrogen, they can all be converted into the paraffin class represented here by Pennsylvania oils. It is perfectly satisfactory to assume, that all types of oils can be traced to one complex mother oil of the asphaltic type.

It would not be reasonable to leave the consideration of the nature of oils without at least slight reference to the most natural question, "Where do they all come from?"

B. THEORIES OF ORIGIN OF PETROLEUM

No one can observe a fountain of oil gushing from the earth at the rate of 40,000 barrels or more per day, coming frequently hot from the interior of the earth accompanied by natural gas, many other gases, steam, hot salt water, etc., without justifiable curiosity as to the origin of this eccentric fuel. This question, fascinating as it is, must be considered to have been speculated upon more than it has been scientifically studied. *Speculation* is naturally easier than *study* of a fountain that has its origin far below the surface of the earth and which took place by various processes, possibly in remote ages—in some cases possibly at much more recent times. The publication of novel theories has resulted in a maze of speculations from which we may select, as typical, three or four views of the origin of oil.

Carbide Theory.—The ease with which acetylene can be made by the action of water upon calcium carbide has done much to expand the carbide theory of the origin of petroleum. There was probably a time in the history of the earth when its temperature was too high to permit any element to exist in combination with another. Experience with the electric furnace has taught us that, on further cooling, carbides would be among the first chemical compounds to exist in the earth. After this, at lower temperatures, water and other compounds must have been formed which would attack the carbides at the earth's surface, giving off acetylene and petroleum vapors. This decomposing action would penetrate more and more slowly into the earth's crust. But the course taken by the water entering the earth, would be that of least resistance, and the more refractory carbides—such as cast-iron—would be left as nodules scattered here and there to be attacked by subsequent invasions of water with the production of various hydro-carbons, including petroleum. According to this theory there would be no difficulty in assuming that the oil is still being formed and that the excessive temperature of some oil might be due to this recent chemical reaction.

Ammonium Chloride Theory.—This carbide theory leads naturally to another idea of the origin of oil, which is decidedly novel, but which is presented more as an appeal to interest, rather than to convince of its probability. Following the line of experiment conducted by a colleague in the United States Geological Survey: On slightly heating a mixture of iron filings and ammonium chloride, the chlorine leaves the ammonium chloride to combine with the iron of the cast-iron. By thus breaking up the ammonium chloride, hydrogen is left free to unite with the carbon which was part of the cast-iron. Here is a direct union of the two elements which make up petroleum, and as you see this mere heat produces something which will burn. This has been carried farther in the laboratory, to the extent of showing that petroleum is the material which burns and that it has actually been formed from the elements. This simple experiment has caused its author, Dr. Becker, to bring to notice the fact that ammonium chloride is a very common constituent of emanations from volcanoes. In fact, much which appears to be steam issuing from volcanoes is in reality ammonium chloride in the form of finely divided dust. He calls attention to the fact that besides meteorites, terrestrial iron, usually high in carbon, is occasionally found in the earth and he is inclined to believe that the opportunity has been frequent for such ammonium chloride to encounter terrestrial iron. Whenever these two have actually come together it is reasonable to suppose that petroleum has been a product. It is going too far to place much confidence in the idea that our vast stores of petroleum are due to chance encounter of these two materials. Still, a peculiar coincidence has also been pointed out by Mr. Becker in the hope of lending plausibility to this theory; he has prepared a map of the oil deposits of the United States and has superimposed upon this a map showing the irregularities in variation of the magnetic needle. It is apparent that some petroleum deposits coincide to an interesting extent with the places where magnetic variation is greatest. This leads Mr. Becker to think that such localities contain deeply buried terrestrial iron, thus influencing the magnet, and it would be a plausible extension of this theory to suppose that petroleum is now being formed from a reaction between such metallic iron and ammonium chloride.

It is, however, just as simple to think that the variation in the magnetic compass in these localities is influenced by local electric

currents which could easily be caused by many kinds of chemical reactions, and we are ready to admit that no material could be converted into petroleum without some form of chemical activity, easily capable of influencing the magnetic needle. Therefore Mr. Becker's map does not increase the probability of petroleum originating from terrestrial iron but it does increase the probability that some petroleum has been developed from recent chemical disturbances in the earth.

Organic Theories.—The idea now most prevalent is that of petroleum originating from animal and vegetable material; it is quite old and lately has been much advanced by the brilliant experimental work of numerous investigators, particularly of Professor Carl Engler, of Carlsruhe, Germany, and Professor Hans Höfer, of Austria. Long before the investigations of these gentlemen took place, Messrs. Warren and Storer, research chemists here in the United States, succeeded in so destructively distilling fish oils as to produce petroleum oils. They actually sold these oils for illuminating purposes. These experiments repeated and extended by Engler and Höfer have given a consistent theory to the effect that ordinary processes of decay of the fatty portions of fish have by successive stages resulted in the formation of petroleum. These minute globules of petroleum scattered here and there throughout the earth's crust have eventually been driven by water into the present oil pools.

Another theory which has long been popular in the United States and which has been developed especially by Professors Orton and Peckham, asserts that the *vegetable* remains in the earth have been equally important as sources of petroleum. These vegetable remains, deposited as peaty masses in clay, have formed bituminous shales which by distillation have yielded petroleum vapors, eventually condensed in convenient reservoirs.

C. ACCUMULATION OF OIL IN POOLS

No matter what the origin of oil may have been, a feature of much greater importance is a study of the processes which have determined the accumulation of large quantities of oil in particular places, usually under such conditions of pressure that when the deposit is punctured by a well the oil will flow to the surface.

It is practically necessary to assume that most of our oil supplies

were at one time widely scattered through enormous masses of sands, clays and other rocks. So widely distributed, in fact, that no possible use could be made of the oil. For example, in the neighborhood of a very large supply of oil in Mexico, I found a certain piece of clay. No one would have suspected for an instant that it was potentially an oil deposit. When, however, this clay was carefully exhausted with ether or chloroform a slight amount of oil was obtained. The amount, in fact, was equivalent to perhaps a barrel of oil per thousand cubic yards. There is, moreover, a natural process by which this oil could be concentrated in a small space. When water comes in contact with an oil-bearing clay, the water is absorbed and the oil is driven out to a large extent, though not completely. The force with which water can drive out oil increases as the capillary space in the clay becomes finer, so it is possible, simply by this means, to drive out under a pressure of from 300 to 400 pounds to the square inch. The direction in which the oil is driven is always from finer capillary spaces into coarser sands, and thus we find oils accumulating under heavy pressures, in rocks where voids are very considerable; thus, in sandstones and beds of pebbles, as in Pennsylvania and West Virginia. It should be remembered that this pressure by which oils are driven from the fine capillary spaces of clays into the comparatively open sands and conglomerates is capillary pressure, and much greater in general than hydrostatic pressure. The process has nothing to do with the relative gravity of oil and water, but is simply caused by the attraction of the clay capillaries for water, as compared with oil. It is a process by which the movement may be up or down or sidewise without reference to gravity. When, however, the oil reaches much coarser material, its further movement is conditioned by gravitation. If no water is present, the oil naturally flows down the stratum of sand to the lowest level it can reach and under such conditions is found in the troughs of the sandstone strata. Should water, however, follow the oil into the sandstone it will naturally take lowest position and force the oil upward along the sandstone layer until it takes the highest position, that is, in the anticlinal folds of these rocks. These conditions are so frequent in the United States that we have come to recognize the existence of an anticlinal fold in a neighborhood where oil is found as the most favorable place to expect a concentration of the oil.

D. NATURAL GAS AND OILS

Oil is almost universally accomplished by gaseous hydro-carbons. Thus natural gas is a feature of almost all oil fields, and in many cases, natural gas has also wandered off through porous portions of the earth and accumulated under great pressures, similar to the oil accumulations. On these journeys it has usually dropped those hydro-carbons which stand midway between liquid and gaseous materials and has become so-called " dry " gas. Where natural gas accompanies the oil to any very great extent, it has furnished the elastic medium by which oil can be pushed out of the sandstones into any well that may serve as a means of its reaching the surface. Naturally, if a well punctures an oil stratum near the top of an anticline or dome, this elastic gas, liberated from the top of the stratum, escapes without pushing any oil before it, and a gas well is the result. This phenomenon has been observed so generally, that curiously enough, most geologists have forgotten in the enthusiasm of their subject, most of the physics they have ever learned, and have conceived the naturally false idea of an oil accumulation as representing three layers in the earth, first gas at the top, then a layer of oil, this followed in turn by the zone of water. The fallacy of this idea is evident from the fact that under the existing pressures all of the natural gas must pass into the form of a liquid with the exception of one member of the series, marsh gas, CH_4, and this under conditions of pressure must be considered as dissolved in the oil, as carbonic acid is dissolved in a bottle of vichy. In fact, there is no phenomenon in regard to the occurrence of natural gas in oil which could not be illustrated by such a siphon of soda water. If the fountain is tapped at the top, gas escapes, if at the bottom, the pressure of the gas forces out the liquid instead of gas. It is advisable at this point to call special attention to a very novel development in the oil and gas industry, which is based simply upon the relation of oil to gas under the conditions which have just been described. Just as the natural gas is capable of solution in oil it naturally carries with it highly volatile oil vapors which are liberated with the gas. Therefore, gas from oil wells, which has the technical name " casing head gas " is rich in very light gasoline and the practice has now come into vogue of obtaining from one to three gallons, and in exceptional cases, four gallons per 1000 cubic feet of gas, by

strongly compressing and cooling these gases, so that the gasoline condenses and is tapped out.

E. ACCUMULATION OF ASPHALTIC OILS

It need not be assumed that all oil deposits have accumulated in the manner described. In fact when an oil originally distributed through a clay has been driven by water into a sandstone reservoir, we know it by the fact that we have a paraffin oil usually thin and more frequently light colored. When oil contains asphalt and is viscous and black, we may be sure that it has never been absorbed by clay and subsequently driven into a reservoir by water. It is more probable that such asphaltic oils have made their way through crevices directly into the nearest formation where the oils could find storage. The essential feature for such a storehouse of oil is in the first place a rock with sufficient porosity to accommodate a considerable quantity of oil. The thicker this stratum, the greater its lateral extent and the greater the proportion of voids, the greater the oil supply, provided the rock is thoroughly saturated with oil. A second requisite is an impervious cover for this oil stratum and a similar protection below to prevent the escape of oil downward into the earth. Very frequently these reservoirs consist of layers of sandstone. Clay saturated with water or even with its finer pores filled with water, is the most efficient cover that can be found for an oil supply. It is even better than hard granite, or hard volcanic rock, because of the prevalence of cracks within the mass of such hard rocks. The usual protection afforded on the under-side of an oil stratum is salt water.

F. PROSPECTING FOR OIL

What guides do the facts thus far given, concerning the accumulation of petroleum in the earth, furnish to aid us in finding a new oil supply? It is evident that no matter how oil originated, whether by the conversion of some animal, vegetable or mineral matter, into petroleum, it was evidently by aid of a chemical transformation. Further, assuming that the great supplies of animal and vegetable remains have here and there been converted into oil, we must recognize that some peculiar accident occurring at one place, and not at another, has converted part of these organic

remains into oils, while other remains vastly greater in extent have not been touched.

It appears that a freak, or chemical accident, of some kind has been effective in one place and not in another. Usually a chemical reaction taking place in the earth leaves various signs of itself by which it can be traced. What are the close associates of oil, the finding of which would point to a possible oil deposit? We know that salt water generally accompanies oil. Salt water, however, is too generally distributed to guide one to oil deposits. Subterranean salt water, as shown by salt springs, is more valuable as an indicator. A more significant associate of oil is natural gas, also asphalt and gypsum (sulphate of lime). Others are sulphur, sulphuretted hydrogen, and sulphide of iron.

If, then, in a new country, an explorer were searching for oil, he would first look for gypsum, salt springs, salt deposits, sulphur, and sulphuretted hydrogen; finding one or more of these indications of oil the explorer would go further and make diligent search for a seepage of natural gas, oil or asphalt along the bank or from the bottom of some stream or spring. In nearly every case where oils have been discovered in the United States or other countries the search has been directed by a seepage of oil or gas. Should no seepage of oil, gas or asphalt be found, the advisability of drilling on account of the presence of other indications depends upon the structure of the land. If the country is so broken up as to give great opportunity for the oil to escape, further search for oil would be useless. With a fairly unbroken country, where gypsum, sulphur springs, etc., are common, the searchers will endeavor to study out the geologic structure of the region so as to find an anticlinal ridge or dome, and be guided by it in beginning drilling operations. These indications are as far as one can safely go. Very many other indications of oil have been pointed out but none of them, so far as my belief goes, have any bearing whatever on the existence of oil.

It should be noted also that up to this point of establishing the advisability of drilling by the observation of seepages, or other strong indications, geology has been of little use. As soon as the seepage is found, however, or other indications of oil, the exact location of the well and the arrangement for the development of a field, after oil has been discovered, must be directed by careful geologic study; in endeavoring to determine the existence of a

dome or anticline by studying the dips of the rock, or, in their absence, by following the sequences by which the various strata of clays, marls, sands, etc., outcrop at the surface.

G. GEOGRAPHICAL DISTRIBUTION OF OILS

A first glance at an oil map of the United States is bewildering in the way in which the oil deposits have been scattered indiscriminately over the country. Further study, however, brings a certain kind of order out of this apparent chaos. It will consume too much time to try to reduce the oil fields to all of the systematic features which have been developed. It is well to point out, however, that the most continuous line of oil deposits in the United States extends from New York through Pennsylvania, West Virginia, Kentucky, into Tennessee, and westward into Ohio. It is perfectly evident that the longer axis of this field is in general parallel to the Appalachian Mountain system. Study of the field shows a definite relationship between the oil pools and the gentler folds of the rock systems a short distance from the west slope of the Allegheny Mountains. Further study shows that these oil pools, as a rule, represent accumulation along anticlinal ridges and in anticlinal domes which result from the folding. It will be noted further that these oils are of a peculiar type. They are the classic paraffin oils of the world—oils that have evidently migrated great distances from the region of formation. In this movement they have lost the asphalt and sulphur probably once contained and by slow general movement they have come into their present positions. It may perhaps be well to point out as a generalization that the further removed an oil may be from its original source, so much the more has it followed general geologic processes tending to distribute the oil much more evenly and to give the oil deposits greater general extent, than where the oil is found as the effect of some accidental accumulation. On the other hand where an oil contains all of the various ingredients characteristic of a mother oil, irregular distribution may be looked for and the chances for the extent of a given field are less satisfactory unless a reservoir happens to exist in the immediate neighborhood of the oil field with phenomenal storage capacity.

Another principle can be indicated in the most general way, however, to the effect that where an oil is found very light in color,

very light in gravity, and unusually rich in gasoline, it is probable that this oil has wandered so far from its original source as to be slight in quantity. The facts necessary for generalization in such directions as this have been acquired so recently that many exceptions will be encountered, and they are given chiefly to indicate new lines of thought to which attention will be called in the oil literature of the future. No one can study a map where oil is so widely scattered without the suggestion that many other oil fields remain to be developed in the United States. Our oil fields have thus far been developed largely by the methods already described in this lecture. There remain great opportunities for applying geological knowledge obtained by the study of these oil fields to other localities where similar conditions are known to exist. It is easy to forecast that, as a result of this study, oil fields will be developed in the near future in the State of Texas to a much greater extent than at present; principally along the northern border and near the Staked Plains, and again in the extreme western portion of Texas in the region of the Pecos River. We have good reason to expect oil developments following the Pecos River into New Mexico. In fact, in the study of New Mexico, seepages existing in great numbers have so far received practically no accurate investigation. Western Colorado and Utah, probably contain oil. While the main Rocky Mountain crest is characterized by conditions too broken up for the existence of much oil, possibilities exist for the development of further deposits to the northeast of the Rockies, in Wyoming, Montana, and North and South Dakota. Oil has already been found, though not developed, in Jefferson County, Washington, in the extreme northwest part of the United States. The indications of oil in Alaska have, thus far, only been sufficiently developed to show the probability of considerable production in the future.

North of the United States line, in Canada, gas deposits of great importance have already been developed and oil seepages have been discovered along Athabaska Lake and River.

As regards Mexico, in spite of the development of that country to the position of third oil-producing country of the world, a visit to the oil fields of Mexico has convinced me that the industry there has only just begun. It is interesting to note that an oil well which is undoubtedly the greatest that has ever been drilled

in the world comes from one of the accidental deposits of oil previously described which has probably not moved far from the place of origin. In fact, the oil evidently was struck in a crevice in limestone where a phenomenally cavernous condition allowed the accumulation of many millions of barrels of oil. Another well of the same type, slightly further to the north, has already yielded nearly twenty million barrels of oil at the rate of 25,000 barrels a day. This is undoubtedly more than has ever been produced by any other well of which we have record, in the United States or elsewhere.

Equally favorable conditions for the occurrence of oil are frequent over thousands of square miles of territory in Mexico and the future of the oil industry of the western hemisphere has been made much more encouraging by this probable great addition to our supply. Mexican oil deposits must be treated as an extension of our own fields. With all of this supply it seems that the immediate future is taken care of for all legitimate needs. There is further satisfaction in the prospect of the future development of fields in the United States of Colombia, Venezuela, and especially in Argentine.

Meantime, in the countries of the East, the outlook for additional supplies of oil is good to the east of the present Russian oil fields. The Island of Sakhalien undoubtedly has large oil resources. The interior of China gives prospects for larger oil development than any other region of the East, even taking into consideration the considerable development in the East Indies and in Australia and New Zealand; but in the time necessary for one journey from the coast of China to her oil fields and return, the United States pipe-lines would have carried enough oil to supply our navy for 25 years.

It is again the fortunate heritage of the United States that oil deposits of probably considerable extent are known on the Islands of Luzon and Mindanao. Nevertheless, for the purposes of the next generation, the United States, together with Mexico, must dominate the oil industry of the world.

CHAPTER II

THE PRODUCTION OF OIL

In the first chapter endeavor has been made to make clear the conditions under which this eccentric material—petroleum—is found in the earth, especially within the United States and Mexico, and to give a general idea of localities where productive oil fields have thus far been developed.

H. THE PRESENT OIL SUPPLY

It is perhaps enough for the purposes of our theme to admit that the development of the oil industry in the United States established our supremacy in oil supply. Further, the remarkable development of the industry enables us to deliver oil, crude or refined, to any oil station throughout the world with an efficiency not dreamed of in other countries. In order to fix in mind a quantitative expression of the oil resources of the United States as known at the present time, it may be stated that it has been calculated that we certainly possess oil resources amounting to ten billion barrels, and probably the known deposits will yield twenty-five billion, distributed over the wide areas in the United States. Frequently where coal is most expensive, oil must be abundant. The greatest proportion of this oil is concentrated upon the Pacific Coast. Oil has been found from the Straits of Juan de Fuca on the northwest border at intervals to San Diego County, California, with indications of its presence also in Lower California. Nevertheless, while a small field will be developed on the Hoh River in Washington, the known valuable fields are concentrated in a few counties of California. Further explorations may develop new fields at other points on the Pacific Coast but it is probable that the greatest supply will be within the general limits of the known fields, because of favorable conditions of occurrence therein existing. Among these favorable conditions are sands sufficiently porous and sufficiently thick. Frequently the oil is quite asphaltic; this is in general fortunate because the oil is ready for use as fuel even without refining. To be sure the oils can be improved for fuel use by refining but this is practically without expense, because of the value of the gasoline and illuminating oils obtained in small percentages when distilling the crude oil to render it safer for fuel purposes. The thickness of

the oil is fortunate, inasmuch as a thin oil occurring under such heavy pressure in the very open sands would, on drilling, gush to the surface with embarrassing rapidity and tend to a brief career for the field. In other words, these thick oils tend to a long life for the region.

The production of oil in California has been brought to the amount of eighty-seven million barrels total for the year just closed. It has been impossible for the consumer to keep up with this production and about fifty million barrels have accumulated as excess stock. Excess oil is still being added to this stock. This would forecast a continued glut of oil on the Pacific Coast. More carefully considered, it is probable that the glut will soon disappear. The productions of 1911 and 1912 only reached their great proportions by virtue of strikes of oil in gushers characteristic of new fields. Every month of the life of the California oil field renders less probable the discovery of further gushers of such extraordinary characteristics. Meantime the advent of salt water into some of the wells is a restrictive feature. It should be noted that the consumption of oil in California in 1912 was greater than the production in 1911. Consumption is growing at even a faster rate than the production, and stocks will probably soon be drawn upon in California. The great development of oil in California has been productive of much good by establishing the use of oil on a firm basis and causing industrial development in that commonwealth which would not otherwise have taken place in many years. It has given confidence in the stability of the oil supply and has convinced the consumer that the prediction of the government to the effect that a great supply of oil could be counted upon in this region for many years, was reliable.

During last year practically all other fields of the United States outside of California declined slightly in their production so that our total barely maintained the high maximum developed in 1911, of 220 million barrels for the production of the country.

Nevertheless, much development of oil may be expected in other fields, notably in Oklahoma (on the west of the present development) and in Texas, where many new pools will probably be developed. Louisiana also gives promise of much greater development in the northwestern part of the state. Meantime a comparatively novel feature is extending the life of the Eastern fields, namely: the ability to drill deeper wells and the discovery of

paying oil sands at greater depths than heretofore utilized. This has extended the oil fields of eastern Ohio further to the west; half of the area of that state may be considered as a practically continuous oil field. With these conditions the total production of the United States should hold to somewhere near the present production for some years to come. This is particularly probable on account of the recent tendency to stimulate production in the East by great increases in the price of crude oil.

The application of increased prices has actually resulted in greatly stimulating drilling in old oil territories. It is easy to forecast that in spite of our enormous production, consumption will increase even more rapidly and we can expect to pay more for our oil in the future than in the past. It is a condition of comparatively rapidly rising market, with the steadying influence to come from the deposits in Mexico. This is the situation with our *present* oil fields. How soon it may all be changed by the accidental discovery of some new great field, is obviously not to be forecasted.

I. OIL WELL DRILLING

It may be only proper to the general interest of the subject of petroleum, before considering the problem in which the navy is more particularly interested—the utilization of fuel oils—to give a brief statement of the methods in general use for producing oil.

Although the methods of drilling for oil originated in China in the remote past, it was only in the year 1859 that modern methods were practically developed in this country at the time of the discovery of oil in Titusville, Pa.—an interval so brief that the original well is not only still in existence but is capable of yielding about one-third of a barrel per day—a larger quantity than is produced by many wells successfully operating. The rapid development of the oil industry since that time has served as an enormous stimulus to the ingenuity of the oil drillers in the United States, and it must be stated that this country has kept in advance of others in successful oil methods and especially in innumerable oil devices usually produced on the spur of the moment to take care of some great emergency. The greatest stock-in-trade of the American oil-driller (and that which gives him a peculiar position as something more than a mechanic and less than an engineer)

is his resourcefulness in time of emergency. It is safe to say that half of the time of the driller is occupied in inventing and applying devices for handling some unique condition which has arisen in the oil wells with which he is associated. This must be thoroughly understood when considering the routine features of oil well development, which are comparatively simple.

Two systems of well drilling prevail in the United States. In the older system, known as the cable or standard system, a drill with a face in the shape of a blunt wedge is raised and dropped through a space of about 6 feet. By the rotary system, a rigid stem of heavy pipe rotates a fish-tail bit at the bottom of the hole, cutting and stirring up the formation to be drilled. The drillings are continuously washed out by a stream of water reaching the bottom through the drill. When necessary, mud is pumped instead of water through the drill and by thus plastering the walls of the hole with mud, caving is prevented when drilling through quick-sand or other formations.

The oil wells of the United States vary in depth from 500 feet or less to over 4000 feet. Shallow pools are frequent in the northern edge of Pennsylvania and over the line in New York, in various localities in Ohio and Kentucky, and in the so-called shallow district of Oklahoma. The deepest successful wells are in California where some exceed 4000 feet. The cost per foot is often as low as $1.00, but increases rapidly with depth.

The standard or cable drilling system is used in hard rocks, and the rotary in softer formations, while frequently both are combined.

J. OIL PIPE LINES

Important considerations from the standpoint of use by the navy are the methods of transportation of these oils from the wells to the refineries and to the seaboard and of then rendering them suitable for use as fuel.

Oil, when it reaches the surface of the earth, either flows or is pumped into preliminary settling tanks of 500 to 1000 barrels capacity, usually of wood, the capacity having been carefully measured, or as technically stated, "strapped." As soon as the temporary storage is filled and the oil has been allowed to free itself from water and sand by settling it is usually connected by small two-inch leader lines of iron pipe to the nearest pipe line

transportation company. It has been a characteristic feature of the United States petroleum industry, and *not* characteristic elsewhere in the world, that no matter how remote from transportation an oil field may be located, if the field is considerable in size, it will be promptly connected with some pipe-line transportation company, usually associated with the Standard Oil Company. An immediate cash market will thus be furnished for the oil. This has become axiomatic in the United States and is responsible for much of the oil development. There is no other commodity, except gold, which always has an instant cash value in the United States, no matter whether the oil must go into surplus storage or is immediately utilized. Whenever a temporary tank at the wells is filled, the pipe-line company is notified to pump it away. The amount is carefully measured and pumped. A copy is furnished to the pipe-line company of the contract existing between the company which has leased the oil field and the owner of the ground. The pipe-line company then delivers a receipt to the oil operator for his proportion of the oil and a receipt to the owner of the ground for a proportion of the oil which represents his royalty interest. These receipts are exchangeable for spot cash. On any succeeding day after the delivery they are exchangeable for cash at the price of the oil on that day. Usually 2 per cent is deducted from the quantity pumped to represent loss by settling, evaporation, etc. This arbitrary practice is hardly considered just, but is the uniform custom. Steel oil tanks usually hold from 35,000 to 55,000 barrels, the latter being more popular. In California, closed cement tanks are constructed to hold over 500,000 barrels. The oil is then piped to the nearest refinery or to the refinery which most needs the particular quality of oil in question.

In this way all the fields east of Colorado are connected by pipelines with the refineries, the main movement being eastward or southward to the coast, where the most important refineries are located. Two pipe-lines reach from Oklahoma to Baton Rouge on the Mississippi. Another important system reaches the Atlantic Coast by way of Whiting, Indiana, passing the Illinois field and picking up a large contribution from that field. Eastern Ohio, West Virginia, Pennsylvania and New York are served by several trunk lines connecting these fields with Bayonne, New Jersey, Philadelphia, Marcus Hook, Pa., and Baltimore. Many

smaller lines supply minor refineries in Ohio, Pennsylvania and West Virginia.

As a rule the oils are so fluid that they are pumped cold with the use of the great pump stations with which you are familiar.

Most of the oils in California and in Mexico pass through steam coils and are thus heated repeatedly in the course of their journey. This is not always *necessary,* but is economy, for the amount of oil used to pump cold viscous oils is much greater than the oil used for heating the oil to 130° F. plus the oil for power to pump these hot oils.

Recently similar pipe-line connections have been made from the new and important Electra field in northern Texas to Dallas and Fort Worth, with connections also through to the coast. The oil fields of Colorado, Wyoming and Utah serve entirely for local purposes and have no bearing on the coast supply.

K. THE EAST COAST OIL SUPPLY

As tending to increase the supply of oil on the Atlantic and Gulf Coasts, it should be remembered that contracts exist between important Mexican producers of oil and the Standard Oil, the Gulf, Producers, and Sun Oil Companies by which crude Mexican oil, principally of the lighter grade, is sent in tank steamers to Bayonne, New Jersey, and to Port Arthur, Texas, as well as to refineries at Marcus Hook, Pa., and to a special asphalt refinery in Baltimore.

Some ten million barrels of oil are now being received from Tampico and Tuxpam, Mexico, into the Gulf and Atlantic ports to augment the supply of the United States. Meanwhile, however, a serious leak in the oil resources of the United States occurs by the constant exporting of crude and refined oils to Europe. In all, this amounts to about 20 per cent of the production of the United States. It has been furnished in the past largely by the Standard Oil Company and a few independent companies located on the Pennsylvania and New Jersey coasts.

CHAPTER III

THE TREATMENT OF OILS

What becomes of the 220 million barrels of oil thus piped to market? To understand the uses of oil is difficult unless we simplify the matter by historical consideration.

L. EARLY METHODS OF TREATMENT

Twelve years ago, before the introduction of western oils, the treatment was as follows: Crude oil was pumped into so-called crude oil stills of 500 to 1000 barrels capacity and heated by a strong coal fire applied directly under the still. The first product to distil over was a mixture of volatile oils known as crude naphtha. This mixture was then pumped into other stills to be re-distilled into various grades of gasoline and benzine. The effort was made to add the heaviest part of this crude naphtha to the next distillate from the crude oil stills, so as to obtain the largest possible yield of burning oil distillate. There is no sharp line to be drawn between burning oil and gasoline; and the kerosene was made to hold all the heavy gasoline (called naphtha) consistent with safety. Ten to twenty per cent of naphtha was obtained and 40 to 60 per cent of kerosene. The residue in the crude still was then pumped while hot into tar stills. Here it was "cracked." So far the separation of the oils was merely mechanical—boiling off and condensing such oils as occur naturally in the crude oil. If this were continued longer, the distillate would be too thick to burn well in a lamp. Therefore, it became necessary to chemically change the oil by breaking it up into lighter oils by heat. These oils *never* distil without some change. If you distil oil many times, it will, by breaking up slightly each time, eventually all be broken up into lighter oils and fixed gases and more or less coke will remain behind. In practice this has been effected by heating the oil gently so that the vapors condensing in the top of the still would fall back and be distilled again and again, each time with some decomposition. The light oils thus produced are bad-smelling but salable, up to a certain point. Eventually they become too dark-colored and too objectionable for sale. Then the fire is increased and the oil distilled rapidly to coke. The oils which distil over directly after this "cracking" process, had little sale except to add to illuminating gas made by the Lowe process, to give color to the flame. They are called

"gas oils." Frequently the market was over-supplied, and this oil was then sold to the manufacturers of glass as a high-class fuel oil, for it could be burned without smoke. This was the original " fuel oil." Mixed with it was also all manner of refinery refuse.

M. ADVENT OF TEXAS FUEL OIL

This condition of things persisted until 1901, when the great pools of asphaltic oils were discovered in Texas on the Gulf Coast. This great quantity was at the time worthless for refining; its price went down as low at 10 cents per barrel. At this low price it was a bonanza for fuel on locomotives. Its use spread to sugar mills and sugar refineries and aided in developing manufacturing. Much was exported. As fuel it was used just as taken from the earth except that live steam was blown through it to expel sulphuretted hydrogen. Two years later the production of heavy oils in Kansas and lighter oils in Oklahoma had outstripped consumption and the Texas railroads began adding the surplus to their fuel supply. The light character of this oil called for distilling off the gasoline and kerosene. Such crude refineries came to be called "topping" or "splitting" plants. They have increased in number and efficiency and now take off just as much light oil as possible to leave a sufficiently fluid residue. Next came the great California development. There the oil was largely burned as crude and this practice still continues, but "splitting" plants are also increasing rapidly in that state.

N. POTENTIAL YIELD OF TREATED OILS

It will be remembered that in 1900, 2 and 4-cylinder automobiles were practically unknown. With their advent the position of gasoline changed and it became the great desideratum. At once there came a change in distillation methods to yield more light products. Our 220 million barrels of crude would, by the old process, have yielded about as follows:

20	million	barrels	Gasoline
65	"	"	Kerosene
20	"	"	Gas oil
20	"	"	Lubricating oil
80	"	"	Fuel oil
15	"	"	Paraffin, coke and loss
220	"	"	Total

This is not enough gasoline. By cutting all the light kerosene possible into the naphtha fraction, this could be run up to 25 million barrels of gasoline and leave 60 million barrels kerosene, but still more is necessary. The first step was to equip the stills with columns for better fractionation of the vapors:—columns similar to those of whiskey distilleries. With these the crude oil is pumped into the still and distilled by a continuous operation direct to coke. The gasoline and naphtha are much more carefully separated from the crude and the maximum yield obtained. The next fraction of illuminating oil, which has been robbed of the heavier naphtha oils is now increased as much as possible at the expense of the gas oils which distil off next. Following the gas oils is the usual yield of lubricating oil containing paraffin wax. This has been the only contribution of fuel oil from the refineries of the East until recently.

9. WHAT ARE FUEL OILS?

Considering the explanation of distilling processes given above, what are fuel oils, as now available?

Crude oil is practically out of the fuel market—this for two reasons. First, the light oil in the crude (even in heavy asphaltic crudes) is a disturbing element and renders the oils unsafe for storage. Second, the light oils are worth distilling off to fill the gasoline demand. Gas oil is produced in greater quantities because the columns on the present stills increase the cracking and with this comes more gas oil. The remainder and greater part of our 80,000,000 barrels of fuel oil is topped crude. The tendency of the fuel supply oil is to grow less because more and more oil is taken off by topping, leaving the thickest oil that the fuel consumer will stand. To lighten this thick oil, it is now a practice (and a good one) to thin the heavy residue by adding the gas oil. Thus the shrewd refiner takes out salable gasoline and kerosene, leaving the residue too thick for any use. He then resorts to his comparatively cheap gas oil and with it thins the oil back to a salable condition as fuel oil. By this means an unexpected gain is achieved. This is easily illustrated. Suppose a fuel oil was found to be so thick that it required 2000 seconds for 200 cc. to run through a certain orifice. To decrease this viscosity, 50 per cent of gas oil might be introduced. The gas oil might have a

measure of its thickness—viscosity of say 100 seconds. The mixture should have a viscosity slightly above 1000 seconds, but in fact it is much thinner.

We may explain this by comparing the condition with what we might have by making a saturated solution of sugar in water and then adding some more solid sugar so that it would remain in suspension. The mixture would be very viscous. Now if we add more water to decrease the viscosity, we first dissolve the solid sugar and by this change in the *kind* of solution, alter the viscosity very greatly.

Such facts have caused the refining technologists to hope for considerable advances in this direction. The various details of the cracking process are being carefully studied.

Refineries are gradually coming to the conclusion that it is possible so to extend this cracking process as to extract very much more gasoline and illuminating oils from heavy crudes than these materials naturally contained. The changes in the refining process due to this development are in their infancy, but it must be borne in mind that improvements in this direction are tending to eliminate the differences between different crude oils and to bring about the possibility of delivering from any crude almost any desired proportion which will best suit market requirements. The considerations on which these improvements are based are by no means simple. To understand them one must recognize certain complications in the character of crude oils which have been given little consideration in the past. We may as well examine one of the most difficult cases, that of the treatment of Mexican crude oil. It must be recognized that this crude oil contains its constituents in differing phases of solution. This oil contains the usual ingredients of gasoline, benzine, small proportions of illuminating oil and heavy lubricating oils, soft asphalt in definite solution in the other oils, together with harder asphalt simply suspended in the oil; suspended also in the oil is finely divided plastic clay. The presence of this finely divided clay enables the oil also to hold in suspension finely divided salt water in a most obstinate emulsion. Just as it is possible to remove the clay and by this means to allow the water to settle out, it is also possible to effect the precipitation of the finely divided asphalt. This asphalt is present also in other oils which contain no water. Such oils are usually very viscous; so much so that when by heating, the small amount of

naphtha which they contain is driven off to give the proper flash, the oil is left too tarry and thick for efficient use as a fuel oil. The gas oil has, as we have seen, besides the thinning effect, that of sending the suspended asphalt into actual solution and thus effectively lessening the viscosity.

P. OILS FOR INTERNAL COMBUSTION ENGINES

Some eight years ago, in visiting an ice-plant, I noticed a peculiar engine burning a very poor quality of Gulf crude oil—it was my first introduction to a Diesel engine. Since then it has become evident that such success in burning asphaltic crude oils is not uniform and that the requirements for fuel oils for internal combustion engines are more exacting. Heavy distillates are satisfactory and it is believed we can go a step farther and by first relieving the oil from its light oils, we can, by adding thoroughly "cracked" gas oils, furnish entirely satisfactory Diesel oils, and thus effectively lessen the viscosity.

So much is still to be learned regarding the possibilities of improving fuel oils by these means that it is hoped that the Navy Department itself will take up the investigation of this topic just as it has so successfully worked out the problem of oil burners. It will thus be in a position to convert the crudest forms of asphalt oils into materials most suitable for combustion on ships, not only under boilers, but for internal combustion; as it must be remembered that the chief requisite for a good oil for Diesel engines is to have it sufficiently fluid to reach the cylinder and be burned without undue deposit of carbon. This leaves the subject of oil in the interesting condition of the present-day experimentation where the events of a few months will probably place these fuel oils in a position for a much more economical and efficient use than at the present time.

Rapid improvements in the engines for internal combustion of oil are in progress. They are also being rapidly adapted to lower grades of fuel oil. Meantime, the oils are being rapidly improved with the result that within a few years, the period of experimentation and of contention between oil and oil-burning engines will be over and the era of oil on the battleship will have settled down to one of satisfactory efficiency.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE EXPEDITIONARY WORK OF THE QUARTERMASTER'S DEPARTMENT

By First Lieutenant Henry N. Manney, Jr.,
U. S. Marine Corps

As a foreword, the writer wishes to make it clear that this article is in no way intended as criticism or derogatory comment on the present preparations of the Quartermaster's Department of the Marine Corps in dealing with expeditions, a subject on which he does not feel himself sufficiently well informed to speak. Rather may it be regarded as the observations and suggestions of a line officer who has been called upon to fill that most confusing of billets, acting assistant quartermaster attached to a unit suddenly organized for duty over seas. It is hoped that these observations and suggestions may be found of value, in view of the fact that the viewpoint of an officer serving in such a capacity would naturally be free from that corps feeling of either line or staff which sometimes leads each department to ascribe any trouble that may arise to the poor headwork of the other.

When one considers that an hour's delay may mean the difference between the peaceful assembly of a force of marines at an advanced base and an armed intervention with attendant loss of life and property—not to mention the cost of maintaining a large force in the field in a foreign country—the first word in expeditionary work is *speed*.

To be sure, we have already obtained a celerity of movement that is a source of pride; but the careful thinker will be forced to admit that it has been obtained in a great measure at the cost of the comfort of the men, which, when all is said and done, is the principal psychological factor of their morale.

Speed, as applied to the subject in hand, may be subdivided

under the following headings: Mobilization of personnel and matériel; loading the transport; proper stowing of the cargo; unloading the transport—all of which primarily depend, for their efficient accomplishment, upon the amount of forethought and preparation devoted to them.

Every company officer who has been on expeditionary service knows the disheartening effect of the stowing and restowing of cargo on the eve of sailing, by men already fatigued by long journeys in heavy marching order. This effect is heightened by the fact that the work must be done by hand, without proper mechanical appliances, up and down ladders and in all sorts of odd corners, and with the full knowledge that the next few days will be spent in frantic search for articles needed at once, articles that should have been the last things put on board but which are generally the first on account of their importance, and which have been carefully consigned to the most inaccessible corner of the deepest hold.

When the expedition disembarks, it is necessary to land first whatever stores and equipage may happen to be on top, regardless of the order in which the articles may be needed by the troops on shore. This is no particular disadvantage when the entire force is landing unopposed and in sheltered waters. On the other hand, if it is necessary to sort out a complete equipment for part of the force, if the presence of a stronger body of hostile troops makes it inadvisable to land all the cargo, or if rough weather makes it necessary to reduce the number of boatloads to a minimum, the delay in separating what is to be landed from what is to remain on the ship may seriously affect the success of the expedition.

The evils described above are as apparent as they are prevalent and unnecessary, but will continue to exist until a proper amount of the antidote of forethought and preparation is administered. It remains, then, to consider the ways and means of making the preparations which will result in the attainment of the desired speed with a minimum of discomfort to the men and of confusion to the officers.

Speed of mobilization (of matériel) can be disregarded in this article, in view of the fact that in the future practically all of our expeditions will start from Philadelphia or some other basic point, where equipage and commissary and ordnance stores have already

been assembled at a depot. The arrangements already in force at the depot in Philadelphia seem to be excellent and difficult to improve upon, as far as they have been completed. These include the assembly and segregation of the various quantities designed to accompany certain units. Here the work of preparation seems to cease, and the trouble begins when the correct quantity in bulk of all kinds of stores is dumped on the wharf and thrown on board the transport in one grand potpourri, with no eye to the assignment of the accessible storage space to the articles that will in all probability be needed first.

The work of supplying the remedy for this state of affairs should devolve upon the officers on duty at the base depot, whose worst handicap at present is the ignorance of the character of the vessels with which they will have to deal. In the past the choice of the means of transportation has run the gamut of battleships, cruisers, gunboats, and colliers, but in the future we can be reasonably certain of the *Hancock, Prairie,* or *Dixie,* as these craft seem to be kept in readiness for duty of that nature.

At this point, while on the subject of transports, a few comments on the ones now in use might not be out of order, although the subject is foreign to this article in that there are none belonging to the Marine Corps nor are there any in charge of the Quartermaster's Department.

The trouble with the ships in present use is that they were neither built nor altered for transport service, nor ever intended to be transports; and there could be no higher tribute to the officers and crews of these ships than the way in which they have cheerfully and efficiently adapted themselves to a service foreign to their profession, and achieved results little short of miraculous. The *Prairie* has no redeeming features as a transport, while the advantages of the facilities on the *Dixie* for baking and distilling are overbalanced by the room taken up by these plants and the machine shops installed for work in connection with the torpedo flotilla.

To return to the work of preparation at the depot: The officers there should be furnished with plans showing all the storage space on all vessels available for use as transports; the number and capacity of the compartments for this purpose should be shown, as also their adaptability for certain kinds of stores as regards shape and ventilation, the shape, size and character of

the passageways leading to them, and the facilities, mechanical and otherwise, for filling and emptying them after others have been filled.

The commanding officers of these ships should be instructed that certain compartments are to be reserved for expeditionary stores, and that all ship's stores contained therein are to be removed at the first word of prospective service.

One (or more) of the officers serving at the base depot should be assigned to each particular transport, or rather, to the stores that will be placed on board that transport, and the storerooms in which they will be placed. It should be regarded as his particular problem to work out, and he should be held responsible for the successful solution. He should go over the ship again and again, blueprint in hand, until he has a mental picture of the various routes and destinations and the various means of handling every pound of bulk that has been set aside as the impedimenta of the largest force that will occupy that ship. His next step should be to divide the storage space into as many districts as there are avenues for filling them, and over each district he should place a reliable non-commissioned officer, requiring him to become perfectly acquainted with his district. Together they should figure out the exact location and strength of the working parties necessary to handle the stores assigned to each district.

From this data a table can be made out, showing just which articles leave the depot first and are stored first, the point at which they will be taken from the trucks and put on board the ship, the district leader to whom they are consigned, along what passage ways they will be handled and where they will be finally stored.

In compiling this table the officer must take into consideration the possible tactical requirements of an expedition by making variations to allow for a flexibility in the distribution. In other words, he must make his arrangements so that the stores and equipage of a company or battalion can be separated from those of the entire force. These preparations having been thoroughly attended to, the depot is ready to load the transport.

Let us imagine that an expeditionary force has been ordered to mobilize at Philadelphia and the officer in charge of the depot has been notified to that effect, the same notification designating the *Prairie* as the transport, and containing the information that the destination of the expedition will be a certain portion of a

specified coast. It further intimates that, though the present intention is to land the entire force in one place, it may be necessary for the ship to distribute one or two battalions by companies at various towns along the shore. If the latter course is decided upon, orders will be sent the ship by radio.

The officer in charge communicates with the navy yard by telephone and is informed as to the present berth of the *Prairie.* He also sends for Captain " X," a depot officer, to whom the *Prairie* has been allotted, shows him the orders, informs him as to the location of the transport and tells him to go ahead.

Captain " X " goes to his desk and takes out the file containing the data for supplying one regiment and stowing the stores for the possible disembarkation of part of the force of the company.

Now let us further suppose that the *Prairie* has been divided into four districts, two of which are fed by cargo ports, and two by cargo booms.

Captain " X " consults his list and telephones the commanding officer of marines at the barracks, requesting that so many non-commissioned officers and men report to Quartermaster Sergeant " A " at such a time, on such a dock, at the forward cargo port of the *Prairie;* so many to Sergeant " B," at the forward cargo boom; so many to Sergeant " C," at the after cargo boom; and so many to Sergeant " D," at the after cargo port. He then assembles the four sergeants in charge of districts, assures himself that they have their lists showing the strength and distribution of the various working parties assigned to them, and gives each the typewritten information showing the order of arrival of each truck at his district, its contents, and where they are to be stowed.

The four non-commissioned officers proceed at once to the *Prairie,* where they station and instruct the working details from the barracks. Large signs numbered " 1," " 2," " 3 " and " 4 " are placed on the dock for the information of the drivers, and all is ready for the arrival of the trucks.

Captain " X " now furnishes the shipping force at the depot with the lists showing the quantity and location of the desired stores, the order in which they are to be loaded on the trucks and the destination of each truck and its load. Having assured himself that the work is progressing favorably, he departs for the navy yard, arriving in advance of, or with, the first truck. Once on the dock, he assumes charge of the loading, remaining as far

as possible in a fixed position, to facilitate the receipt of communications, and controlling the situation by means of messengers.

As soon as a truck is loaded at the depot, the driver is furnished with a slip showing the district to which it is consigned, the number of the truckload and the number and contents of the boxes and packages of which it is composed. This slip is received by the sergeant in charge of the district, who checks it off on his list and sees that the stores are started along their proper channels and reach their intended compartments.

By means of a portable telephone, Captain "X" keeps the depot informed of the progress of the work and increases or decreases the flow of stores into each district according to the rapidity with which each district is able to assimilate the quantity delivered. For instance, if district No. 1 should show signs of congestion, the depot would be directed to truck only to the other three districts for a stated period of time. The depot, from its end, keeps Captain "X" informed as to the time that each truck leaves, its contents and destination. In this way Captain "X" can tell from a glance at the check marks on his sheets just what he has on board, on the dock, and *en route*.

By the time that the troops are mobilized, the loading of the transport should be practically completed, and upon its completion Captain "X" turns over to the expeditionary quartermaster the invoices for the stores in bulk, a diagram showing the location of the storage spaces and their contents, the avenues best adapted for breaking them out, and the districts into which the ship has been divided. He further furnishes him with copies of his data regarding the position and strength of the working details, and those showing the order in which stores should be moved to be best adapted to meet possible future tactical distributions of the troops.

The transport having sailed, it now becomes necessary for the expeditionary quartermaster to acquaint himself thoroughly with the data given him by Captain "X." Having done this, he selects men from his department and assigns them to the four districts previously mentioned, furnishing them with the necessary information to enable them to locate and handle without delay any and all articles that may be desired.

The adjutant should be required to detail from the last unit to be disembarked the necessary non-commissioned officers and

men for the working details, who should be instructed in the names of the compartments in which they are to work, their location, and the persons to whom they are to look for orders.

The next duties of the quartermaster are to inform himself concerning the means that will be available for transferring his supplies to the shore and to make arrangements to meet any contingency that may arise. It he is compelled to use the ship's boats, he must ascertain which are at his disposal, the capacity of each, and of what each boatload will consist. If other means can be obtained and it is not necessary to use the boats, he should acquaint himself with them well in advance, bearing in mind the satisfactory completion of his task depends on being prepared in advance for any emergency that may arise.

[COPYRIGHTED]
U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A HALF CENTURY OF NAVAL ADMINISTRATION IN AMERICA, 1861-1911

By CHARLES OSCAR PAULLIN

X

THE NAVY DEPARTMENT, 1897-1911

The Spanish-American War was the principal event in the history of the navy and the Navy Department during the period 1897-1911, and by reason of its epoch-making results it has been the chief factor in shaping the recent naval policy of the United States. The war gave an impetus to every naval activity. It accelerated the building of ships, the increase of officers and seamen, the improvement of the navy yards and the establishment of naval stations, coaling depots, magazines and hospitals. It left its mark upon the organization of the Navy Department and of the naval service. Its effect upon the amalgamation of the line and the engineers and upon the provision of adequate educational facilities for naval officers was far-reaching. Since the war the improvement in the materiel and the personnel of the navy has gone on hand in hand. As a result of the brilliant victories of Dewey and Sampson, which greatly popularized the navy, large sums of money have been freely granted for naval purposes.

For a little more than half of the decade 1897-1907, the Secretary of the Navy was John D. Long, of Massachusetts. Entering the department in March, 1897, as the New England member of McKinley's cabinet, he served through McKinley's two administrations and a part of the first administration of Roosevelt. He had had a varied political career as a member of the Massachusetts legislature, governor of his state and one of its representatives in Congress. Secretary Long was conservative, steady-going and of a

judicial temperament. In his love of books, gift of diction, integrity of character and ethical view-point, he was a typical New Englander. He had published a translation of the Æneid and a volume of after-dinner speeches, and, soon after his resignation from the secretaryship in 1902, he issued a book on the "New American Navy." His habits were exceedingly democratic, and, in Massachusetts where he was familiarly known as "Governor Long," he was popular with all classes. His appearance was plain, but striking; and is still vividly recalled by the employees of the department. He was short and stout, with broad, stocky shoulders, topped with an enormous head. He came promptly and early to office, and usually carried with him a green bag well stuffed with documents and papers. His rusty silk hat and cheap suit of ready-made clothes contrasted oddly with the dress of his polished and well-groomed colleague in the State Department, the late John Hay. In a novel published some years ago, one of the characters, "Mr. William Shortley, commonly called Billy Shortlegs," was modelled after Mr. Long. Shortley was "very popular, well up in classics, and stands a good chance of being governor some day." He was a "short man, with a corpulent body and a large, open face; but he was a born orator of a certain type. Rounded and polished, mellow and musical, his sentences rolled from his mouth in liquid cadence and perfect balance. Sir Hugh put him down as his ideal after-dinner speaker. He made his points, clearly, neatly, and with occasional vigor that was always surprising." [229]

On May 1, 1902, Secretary Long was succeeded by W. H. Moody, of Massachusetts, and after a little more than two years of service, Moody, on July 1, 1904, yielded his position to Paul Morton, of Illinois. One year later Morton resigned, and Charles J. Bonaparte, of Maryland, became Secretary of the Navy. On December 17, 1906, Bonaparte gave way to Victor H. Metcalf, of California, who, on December 1, 1908, was succeeded by Truman H. Newberry, of Michigan, Roosevelt's fifth and last Secretary of the Navy. President Taft's choice for the naval office was George von L. Meyer, of Massachusetts. Moody's career in the House of Representatives, where he served in the 54th, 55th, 56th and 57th Congresses, recommended him as a man of

[229] Hoar, Autobiography, I, 299.

ability and integrity. Following the precedent established by two of his predecessors in the department, Thompson and Woodbury, Moody became a justice of the Supreme Court. Morton's success in administering railroads and manufacturing industries seems to have been his principal recommendation for the secretaryship. The choice of a man of affairs to be Secretary of the Navy was in a way a return to an earlier practice, which obtained before 1818, when the rule of the lawyers and statesmen in the department began. Morton was the second incumbent of the secretaryship to hail from an inland state, and Newberry the third. Bonaparte was an intimate friend of President Roosevelt, whom he somewhat resembles in character. Both are independent in temper, zealous for reform, fearless in initiative and strenuous for their ideals. Metcalf is the first man from the Pacific Coast to become Secretary of the Navy. He had been a member of Congress and Secretary of the Department of Commerce and Labor. Long, Moody, Bonaparte and Metcalf were bred to the law. Newberry and Meyer were capitalists and men of affairs.

Secretary Long's Assistant Secretary of the Navy for a little more than a year of his administration was Theodore Roosevelt, of New York, a most picturesque and masterful personality. He served from April, 1897, until May, 1898. In the Navy Department Roosevelt displayed his well-known qualities of omniscience, quickness on the trigger, self-confidence and indefatigable industry. Early in his life he became interested in the navy, and at the age of twenty-four published a history of the Naval War of 1813. He brought to the assistant-secretaryship a considerable first-hand knowledge of naval history and naval affairs. During his brief term in the department, he greatly magnified his office, and made himself felt as an influential factor in naval administration. Possessed with unusual powers for acquiring information, he left the department with a rather extensive knowledge of the navy, and certainly with decided opinions in respect to it. As President of the United States, these have stood him in good stead. In his first message to Congress not less than one hundred specific points connected with the navy were raised and discussed. His judgment of naval affairs was not infrequently better informed than that of his secretaries of the navy, several of whom were wholly unacquainted with their duties on first entering upon them.[220] Indeed,

[220] United Service, ser. 3, V, 291; Army and Navy Journal, XXXIX, 61.

outside of the naval officers, few men in official life had a more intimate knowledge of the navy and its wants than President Roosevelt. Its rapid enlargement formed a most important part of his policy of rampant nationalism. Roosevelt is one of the very few presidents who have been strong, positive factors in the administration of the navy.

Secretary Long's book, the New American Navy, contains a vivid characterization by the author of his chief civilian assistant in the Navy Department:

"Mr. Roosevelt was an interesting personality as Assistant Secretary of the Navy, as, indeed, he is in any capacity. There were several candidates for the place, which President McKinley allowed me to fill. In May, 1897, on the retirement of Mr. McAdoo, an excellent official under the previous administration, who had consented to hold over till that time, I selected Mr. Roosevelt, who had had, and indeed has had to this day, a hearty interest in the navy. His activity was characteristic. He was zealous in the work of putting the navy in condition for the apprehended struggle. His ardor sometimes went faster than the President or the department approved. Just before the war, when the Spanish battle-fleet was on its way here, he as well as some naval officers, regarding that as a cause of war, approved of sending a squadron to meet it without waiting for a more formal declaration of war. He worked indefatigably, frequently incorporating his views in memoranda which he would place every morning on my desk. Most of his suggestions had, however, as far as was applicable, been already adopted by the various bureaus, the chiefs of which were straining every nerve and leaving nothing not done. When I suggested to him that some future historian reading his memoranda, if they were put on record, would get the impression that the bureaus were inefficient, he accepted the suggestion with the generous good nature which is so marked in him. Indeed, nothing could be pleasanter than our relations. He was heart and soul in his work. His typewriters had no rest. He, like most of us, lacks the rare knack of brevity. He was especially stimulating to the younger officers, who gathered about him and made his office as busy as a hive. He was especially helpful in the purchasing of ships and in every line where he could push on the work of preparation for war. Almost as soon, however, as it was declared, he resigned his assistant secretaryship of the navy to accept the lieutenant-colonelcy of the Rough Rider regiment in the army. Together with many of his friends, I urged him strenuously to remain in the navy, arguing that he would there make a signal reputation, and that to go into the army would be only to fight mosquitos on the Florida sands or fret in camp at Chickamauga. How right he was in his prognosis and how wrong we were in ours, the result has shown. He took the straight course to fame, to the governorship of New York and to the presidency

of the United States. He has the dash of Henry of Navarre without any of his vices.[231]

On May 11, 1898, Charles H. Allen, of Massachusetts, Roosevelt's successor, became Assistant Secretary of the Navy. He brought to his task a thorough training in business and an aptness for administrative work. On April 21, 1900, Allen resigned to become governor of Porto Rico, and was succeeded by Frank W. Hackett, of Washington, D. C. Hackett was born in Portsmouth, New Hampshire, and during the Civil War was a member of the naval pay corps. He served until December 16, 1901, when Judge Charles H. Darling, of Vermont, became Assistant Secretary of the Navy. Darling was a decisive man, with a judicial temper and a sound judgment. On November 1, 1905, he was succeeded by Truman H. Newberry, of Michigan. Newberry had seen service in the navy during the Spanish-American War. He was succeeded on December 1, 1908, by Herbert L. Satterlee, of New York, who served until the end of Roosevelt's administration. President Taft's Assistant Secretary of the Navy was Beekman Winthrop, of Massachusetts.

The war of 1898 and the rapid expansion of the navy succeeding greatly increased the work of the naval bureaus. Secretary Long on more than one occasion testified to the professional skill, valuable counsel and painstaking labors of his bureau chiefs, and he said that the importance of their services during the war was too little known and that they, as well as the commanders of ships, ought to be rewarded for conspicuous merit. The chiefs of the several bureaus during the war of 1898 were as follows: Bureau of Navigation, Commodore A. S. Crowninshield; Bureau of Equipment, Commodore Royal B. Bradford; Bureau of Ordnance, Commodore Charles O'Neill; Bureau of Yards and Docks, Commodore M. T. Endicott; Bureau of Construction and Repair, Commodore Philip Hichborn; Bureau of Steam Engineering, Commodore George W. Melville; Bureau of Supplies and Accounts, Commodore Edwin Stewart; and Bureau of Medicine and Surgery, Commodore William K. Van Reypen. The head of the Marine Corps was Colonel-Commandant Charles Haywood.

Endicott, who was appointed chief of the Bureau of Yards and Docks on the recommendation of Secretary Long, was a civil engineer of the navy. Previous to his appointment, this position

[231] Long, New American Navy, II, 173-175.

had been filled by a line officer, who of course had no expert knowledge of civil engineering. Information of this sort is highly valuable to the chief of this bureau, since he is principally engaged in the improving of navy yards and naval stations and in the construction of buildings and docks. In 1901 F. T. Bowles, a brilliant young naval constructor, succeeded Rear Admiral Hichborn as chief of the Bureau of Construction and Repair, a position of great importance. In 1903 Rear Admiral Melville, who had been chief of the Bureau of Steam Engineering since 1887, was succeeded by Chief Engineer C. W. Rae. In 1902 Rear Admiral C. H. Taylor took the place of Rear Admiral Crowninshield as head of the Bureau of Navigation. Various other changes in the headships of the bureaus have been made from time to time. An assistant to the chief of the Bureau of Ordnance was authorized in 1898.

By all odds the most important addition made to the administrative machinery of the Navy Department for many years was that of the General Board, which was established in 1900. An account of this organization, however, is appropriately preceded by a brief description of a temporary board of a somewhat similar character, which was organized to assist the Secretary of the Navy in conducting the war with Spain. The "Naval War Board" or "Naval Strategy Board" was created in the spring of 1898, with the following membership: Rear Admiral Montgomery Sicard, Commodore A. S. Crowninshield, who was at that time chief of the Bureau of Navigation, Captain A. S. Barker and Assistant Secretary of the Navy Theodore Roosevelt, chairman *ex officio*. In May Captain A. T. Mahan (retired) became a member of the board, and Captain Barker and Assistant Secretary Roosevelt severed their connection with it. At one time an army officer reported as a member. During the greater part of the war it consisted of Sicard, Crowninshield and Mahan, the two last-named officers being its most active members. It was closely connected with the Bureau of Navigation. The board was dissolved in the fall of 1898, shortly after the war had been concluded.

The principal duties of the Naval War Board were to collect military information, to prepare strategical plans of war, to advise the Secretary of the Navy in regard to questions of naval strategy and policy, and to assist him in conducting the naval war. It

gathered information respecting the movements, resources, conditions and plans of the Spanish naval forces. Its two principal agents abroad were Ensigns W. H. Buck and H. H. Ward. These officers travelled under assumed names and characters, representing themselves as Englishmen. In reporting the movements of Admiral Cervera's fleet, Ward visited Cadiz, Gibraltar, the Madeiras, St. Thomas and Porto Rico, and several times narrowly escaped detection. Buck followed the course of Admiral Camara's fleet through the Mediterranean, going as far east as Port Said. On the retrograde movement of Camara, he returned to Algiers. These two officers had many thrilling experiences, and exhibited much cleverness and sagacity in executing their difficult and delicate missions. The Naval War Board performed its part in the war with signal success and distinction, and to the great satisfaction of Secretary Long, who said that it did not make a single error, and that its deliberations were distinguished by wise judgment, comprehensive forethought and a competency to every contingency.[232]

Shortly after the Naval War Board was dissolved, a movement for the establishment of a somewhat similar organization was set on foot. It was argued that a permanent war board would do away with the necessity of extemporizing a temporary administrative organ in case of another naval war. The friends of the movement, however, laid most stress upon the need of an organization within the department for the performance of a number of highly-important naval duties, which properly fell to none of the several bureaus and offices, and which therefore were not well done. Among these duties were the preparation of plans for war, the study of strategical problems, the collection of military information, the co-ordination of the work of the bureaus, and the advising of the Secretary of the Navy. Some of the critics of the movement saw in it merely another attempt of the line officers of the higher ranks to gain control over naval administration, and they asserted that the proposed duties of the new board were already adequately performed by the Naval War College, Naval Intelligence Office, Bureau of Navigation, Office of the Secretary of the Navy, or some other administrative division

[232] House Doc., 55C. 3S., No. 3, 33-34; Army and Navy Journal, XXXV, 669, 703, 771, 1079.

of the department. They thought that they discovered in Admiral Dewey's "general board" or "general staff" the reappearance of Admiral Farragut's "board of admiralty," or of Admiral Porter's "board of control." The arguments now used, however, were somewhat different from the old ones. Formerly, the need of a unifying and advising power in the department was emphasized, while now the need of some organization to prepare plans of war and other military information was chiefly dwelt upon.

The name generally given to the proposed board was the "general staff," or the "naval general staff." Several years before the war of 1898, the need, or alleged need, of our navy for an organization of this sort had been pointed out by some of the naval officers. European practice, they said, had clearly established the great value of a general staff. The "military general staff" originated in Sweden when Gustavus Adolphus made his army the model of the civilized world. Thence it found its way into Prussia under the Great Elector. In Germany it had had a natural growth and development for two hundred and fifty years. The present German general staff contains some eight hundred officers, and its organization is quite complicated. The grafting of this institution upon the American navy was not contemplated. What was proposed was the introduction of a highly-modified form of the German or European general staff.[233]

In the winter of 1899-1900 Captain Henry C. Taylor, who had given much consideration to the subject of naval administration, submitted to Secretary Long a memorandum setting forth the duties and organization of a general staff and the needs of the navy for such an institution. Long did not wholly agree with Taylor, and he was opposed to the establishment of a general staff upon the plan suggested by its friends. He could not see his way clear to do more than to organize a general navy board, which he effected by an order of the department, dated March 13, 1900. The General Board was to be composed of the following officers: the Admiral of the Navy, who was to act as president, the chief of the Bureau of Navigation, who was to preside in the absence of the president, the chief intelligence officer and his principal assistant, the president of the Naval War College and his principal assistant, and three other naval officers of or above

[233] United Service, ser. 3, V, 2.

the grade of lieutenant commander. The chief of the Bureau of Navigation was to be the custodian of the plans of campaign and of other military information prepared by the board. The duties of the new organization were not specified in detail. Its purpose was "to insure efficient preparation of the fleet in case of war and for the naval defense of the coast." It was to meet at least once a month, and two of its sessions each year were to extend over a period of not less than one week each, during which time it was to meet daily. Five members were to form a quorum.[234]

On April 16, 1901, the provision respecting membership was modified,[235] and the board was made to consist of the following officers: Admiral George Dewey, president; the chief of the Bureau of Navigation, the chief intelligence officer, the president of the Naval War College, and such other officers of or above the grade of lieutenant commander as the department may designate. In April, 1902, the board comprised eleven members; and in April, 1904, thirteen. On the latter date four additional officers were on duty with the board, and two officers were engaged under its direction in the study of target practice. Counting its members and its assistants, the board at this time consisted of nineteen officers.

The Regulations for the Government of the Navy issued in 1905 again changed the membership of the board, which was made to consist of the four officers specifically enumerated above, and of such additional officers above the grade of commander as may be necessary to maintain the total membership at seven. An officer above the grade of lieutenant was to act as secretary, and was to record the proceedings of the board and have charge and custody of its files and correspondence. When the exigencies of the service permitted, the department was to order to appear before the board, upon its request, officers of special experience or fitness whose knowledge and suggestions might be of assistance in its deliberations. Such officers might take part in the discussions, but they could not act as members. The regulations for 1905 specified with considerable detail the duties of the board.

[234] Long, New American Navy, I, 123-124; General Orders of Navy Dept., No. 544.

[235] General Orders of Navy Dept., No. 43.

It was to devise measures and plans for the effective preparation and maintenance of the fleet for war, and was to advise the Secretary of the Navy as to the disposition and distribution of the fleet and as to the re-enforcements of ships, officers, seamen and marines. It was to prepare and revise plans of naval campaigns, and was to consider the number and types of ships proper for the fleet, and the number and rank of the officers and the number and ratings of the enlisted men. It was to advise the Secretary of the Navy concerning the location and arrangements of coaling depots, naval stations and depots of ordnance and supplies. It was to undertake the co-ordinating of the work of the Naval War College, Office of Naval Intelligence and Board of Inspection and Survey, and it was to consider and report upon naval operations, maneuvers, tactics, organization and training. Finally, it was to perform such additional duties as might be prescribed from time to time by a competent authority.[233]

Since its organization in 1900, some of the ablest officers of the navy have served on the General Board. It has prosecuted its work with vigor and success, and has collected much military information, prepared plans of war, constructed shipbuilding programs and advised the Secretary of the Navy upon professional subjects. It has largely extended the sphere of its powers and influence. According to Assistant Secretary Darling, the General Board, in 1904, was in practice the most influential and the most controlling force in the navy. Although it had no authority to issue orders, nevertheless, on a proposition fairly within its jurisdiction, it outweighed the judgment of any bureau. Both Secretary Long and Assistant Secretary Darling were of the opinion that it was encroaching on what they considered the field of civil administration. Darling's view may be obtained from his testimony before the House Committee on Naval Affairs, given in April, 1904:

> I think the board has done some good work and is a good institution, but I would restrict rather than extend its powers and authority. The board has taken up a great many things that it ought not to. It has taken up the question of title to land—work that could be done in any law office, and which has no more military or tactical significance than the administration of a law office. It has undertaken the purchase of land. It has attempted to administer navy yards. It has undertaken to locate

[233] Regulations for the Government of the Navy, 1905, pp. 12, 19.

storehouses, machine shops, and other buildings within naval reservations. These questions are entirely without military significance. It has undertaken to inform the department what legislation was needed. It has devoted much time and attention to the reorganization of the Navy Department, as well the civilian as the military side. It has prepared and circulated much literature advocating a general staff. In short, it has already invaded the province of civil administration and planted there the standard of conquest.[237]

The advocates of a naval general staff were by no means willing to accept the General Board as a substitute for the more powerful organization, and they conducted a lively propaganda in its behalf. Nominally, the General Board had only advisory powers. The general staff, however, was to possess affirmative powers of administration and was to exercise more or less control over the bureaus. The directive force of the navy was to become naval or military, as is the case with European navies. As a matter of policy, these facts were not always put to the forefront, but sometimes they were clearly stated. Secretary Moody favored the organization of a naval general staff, and in his annual report for 1903 President Roosevelt warmly advocated it. As a step towards its introduction, it was proposed to obtain legislation legalizing or incorporating the General Board. With this in view a strong fight was made by the friends of the movement in the spring of 1904. Important hearings upon the proposed legislation were held before the House Committee on Naval Affairs. Among others, Secretary Moody and Admiral Dewey spoke in its behalf. Assistant Secretary of the Navy Darling vigorously opposed it. His exceedingly able argument went far towards causing the committee to drop the measure. The fight for a naval general staff has been merely postponed. The sentiment in favor of it among the older line officers of the navy is very powerful. Moreover, the army has obtained an organization of this sort, and the navy naturally feels that its claims and needs are as well founded as those of its sister-service.[238]

It is plain that the organization of a general staff involves some fundamental questions of naval administration. Not the least of

[237] Hearings before House Com. on Naval Aff., April, 1904, pp. 927-935; Long, New American Navy, II, 183-185.

[238] Ann. Rept. of Sec. of N., 1905, pp. 3-6; Ann. Rept. of Bureau of Nav., 1905, pp. 4-6; Ann. Mess. of Pres., 1903; Hearings before House Com. on Naval Aff., April, 1904, pp. 909-991.

these is the proper division of duties and powers between the civil and naval elements of the Navy Department. Without attempting to discuss this subject, a few observations on it may be ventured. That the military should be subordinate to the civil function is one of the unwritten laws of our government. The secretaries of the army and navy must therefore be civilians. Now, the selection of a civilian Secretary of the Navy involves the anomaly of placing an amateur or novice in naval affairs over a body of professional and expert naval men. Such a system has its obvious defects. It weakens the Navy Department at its apex. The secretariat fails to become an adequate correlating and unifying force. Unnecessary friction arises between the secretary, more or less ignorant of his duties, and his naval chiefs. The technical naval men have never welcomed the exercise of positive powers of direction and control by untechnical civilians. Undoubtedly naval affairs would be vastly better conducted could the Secretary of the Navy bring to his work a hand practised in naval administration, the knowledge and assurance which come from long experience in the navy or the department, and the full understanding of one who is familiar with the customs, traditions and prejudices of naval officers and with their habits of thought and action.

On the other hand, the present system possesses certain counter-balancing advantages. A civilian secretary provides the department with one of its greatest needs, a judicial and impartial mind that has no service prejudices. A naval officer as secretary could hardly keep a level keel amid the animosities and diverse interests of conflicting naval corps. A civilian secretary is more likely than a naval one to understand the temper of Congress, to work in harmony with it and to obtain the necessary means for conducting the navy. Moreover, the present system gives assurance that the civilian point of view shall have due weight in the department, where the naval point of view is adequately represented by the bureau chiefs. In a very real sense the Secretary of the Navy is a minister of the people sent to the department to represent their opinions and prejudices in the naval counsels. He mediates between the people and the navy.

In the practice of the Navy Department many unwritten laws, customs and usages have grown up. An accurate knowledge of them is difficult to obtain. Moreover, they differ somewhat under

different administrations. In the official communication of bureau with bureau, or the secretary's office with the bureaus, custom and the orders of the department have definitely fixed the procedure. Thus, a uniform method of briefing, indexing and referring of letters and documents is followed. A sort of code of official routine has been evolved which methodizes and facilitates the business of the department. The routine of business within the bureaus is also fixed. Owing to the necessity for a division of labor, most of the bureaus fall into divisions which are unknown to the law. For instance, the "office of detail" still constitutes a well-defined division of the Bureau of Navigation. As its name indicates, the Bureau of Supplies and Accounts is composed of a division of supplies and a division of accounts. In the Bureau of Construction and Repair there is a division of drafting. The office of the Secretary of the Navy may be divided into the division of the Secretary of the Navy, the division of the Assistant Secretary, the division of the Disbursing Officer, and the division of the Chief Clerk. The latter officer is a most important one, having charge of the correspondence of the secretary's office, the expenditure of the contingent funds, and the civilian personnel of the department.

The duties of the Secretary of the Navy, and also his relations to the chiefs of bureaus, to the President and to Congress, are for the most part not determined by law, but fixed and sanctioned by precedents, customs and forgotten orders of the President. The practice of making an annual report is unknown to the law and did not exist in the early history of the department. The first annual report appeared in December, 1823. It is an invariable rule that a senator or representative who calls to see the Secretary of the Navy shall be admitted to him. There are many unwritten customs respecting naval legislation. The two naval committees of Congress practically decide the amount of the annual appropriations for the navy, the uses to which this money shall be applied and the numbers and types of new ships. In reaching conclusions, they are assisted by the Secretary of the Navy, the chiefs of bureaus and the members of the General Board, who are called before the committees to explain their estimates and recommendations and to give all sorts of naval information. The Secretary of the Navy is the servant of Congress as well as of the President. Conferences on naval problems are often held between

the President and the members of the naval committees. It is scarcely too much to say that the Secretary of the Navy, the chiefs of naval bureaus, the members of the General Board, the President of the United States, the Speaker of the House and the leading members of the two naval committees, constitute a grand committee on naval legislation, whose members, by conference or otherwise, resolve differences, compromise conflicting interests, bring the legislature and executive to an understanding and reach an approximate agreement upon naval legislation.

Among the few duties of the Secretary of the Navy that are prescribed by statute are the preparing of estimates of the annual appropriations, and the reporting annually of the expenditures of the department, contracts for supplies, and the vessels and naval materials that have been sold. The laws sometimes authorize the Secretary of the Navy to perform some special duties, such as the appointment of a board of naval officers, the making of a specified contract, or the locating of a naval station. At the department, the chief duties of the secretary are the reception of visitors bound on public or private errands, the conferring with the principal officers of the department and the navy, the conducting of his official correspondence, and the signing of his name to numerous official letters and documents, such as naval contracts, orders for the payment of money, orders to officers and naval commissions. If he is a lawyer, he may spend considerable time in reading the proceedings of courts-martial. He acts as the governor or balance-wheel of the department, and may be called upon to settle the disputes which arise between the naval bureaus. Ordinarily, the administrative machinery runs of its own momentum, without unnecessary friction, and the secretary may absent himself from his office for considerable periods of time without much inconvenience to the department. Of the great mass of correspondence of the department, the secretary sees nothing. Only the most important papers come to him. A month or more may elapse between the visits to him of some of the chiefs of bureaus. On the other hand, the chief of the Bureau of Navigation consults with him almost daily. The bureaus are semi-independent principalities, whose obligations to their suzerain, the secretariat, are rather slight.

The duties of the Assistant Secretary of the Navy are fixed principally by the orders of the secretary, and only slightly by law

and custom. They vary considerably with different administrations. They were somewhat limited by Secretary Long in April, 1897, but they were much increased during and after the war with Spain. The regulations for the government of the navy issued in 1900 assigned to the assistant secretary cognizance and general supervision of all matters relating to the "Islands of Guam and Tutuila and the United States naval stations in island possessions and elsewhere beyond the continental limits of the United States; vessels in building at navy-yards; repairs to vessels, ships fitting for sea; tugs and other boats for service at navy yards; the Marine Corps and applications of enlisted men thereof for discharge; the Naval Militia; the Naval War College; the Library and War Records Office; reports of boards of survey; surveys and appraisals afloat and ashore; the loaning of flags belonging to the navy." In December, 1901, the Naval War College was placed under the direction of the Bureau of Navigation. In the fall of 1905 the duties of the assistant secretary were considerably modified by Secretary Bonaparte. He was now relieved of much of his strictly routine work. He was required to make personal inspections of ships and naval stations, and to examine into the fitness of all candidates for commissions in those branches of the navy that are recruited from civil life.[239]

In February, 1899, Congress provided for the regular establishment of the Office of Naval Intelligence.[240] This office had previously existed only by authority of the orders of the Navy Department. Some of its clerks were detailed from the bureaus, and others were paid out of the appropriations for the "increase of the navy." Congress now authorized the office to employ five clerks, a translator, a draftsman and a laborer. The office was organized into six divisions, as follows: "Naval attachés," "ships," "ordnance," "personnel," "communications" and "steam engineering," each of which was to be presided over by an officer of the navy. In 1899 four naval attachés reported to the office. Three of these were attached to the American embassies or legations in Europe, and one to our legations at Tokyo and Peking. The work of the Naval Intelligence Office has greatly increased since the war with Spain. The head of the office is called the "chief intelligence officer."

[239] Ann. Rept. of Sec. of N., 1900, p. 67; 1905, p. 16.

[240] U. S. Statutes at Large, XXX, 874; Ann. Rept. of Sec. of N., 1899, pp. 464-466.

During recent years, the Navy Department, if we may rely upon the judgment of its secretaries, has continued to suffer from an excessive division of responsibility and executive power. It is recollected that this evil was chiefly manifested in the shipbuilding bureaus. Among their chiefs, considerable ill feeling was often aroused over conflicts of authority. According to Secretary Long, their relations were sometimes so strained that ordinary courtesy was impaired. Long frequently recommended the consolidation of the Bureaus of Construction and Repair, Steam Engineering, and Equipment. This change was not considered advisable or advantageous by many officers of high rank and conspicuous ability and by many members of the naval committees. Little attention was therefore paid to the secretary's recommendation. In his annual report for 1905 Secretary Bonaparte submitted some observations on the organization of the Navy Department. He conceived that the system of autonomous bureaus was in theory open to very serious objections, and was attended in practice with some measure of friction, circumlocution and delay. He suggested that the department might be organized into four bureaus, dealing respectively with "men," "ships," "armament" and "supplies." This suggestion is similar to one made by Secretary Whitney in 1885.[241] In his annual report for 1906 Bonaparte elaborated his plan of departmental organization. He now proposed that the head of one of the four bureaus should be the Secretary of the Navy, of another the assistant secretary and of each of the two remaining bureaus an officer of flag rank. Despairing of aid from Congress, Secretary Newberry began to reform the department by executive order shortly before his term of office came to an end. Secretary Meyer followed the same method. In 1909 he appointed four aides, one each, respectively, for "operations," "personnel," "materiel" and "inspections," to advise him in their respective fields and to co-ordinate the work of the bureaus. In the following year he abolished the Bureau of Equipment, and later he undertook to improve the business methods of the department.

The rapid increase in the number of civilian employees of the Navy Department in Washington during recent years is wholly

[241] Congressional Record, XXXV, 5393; Long, New American Navy, I, 117; Ann. Rept. of Sec. of N., 1905, pp. 3-4.

unprecedented. The number in 1897 was 282; in 1905, 608.[242] With unimportant exceptions the personnel of every bureau and office was increased. The Navy Department building was too small to accommodate the additional force, and great inconveniences were suffered from the overflowing of its rooms. In 1903 the "Naval Annex" was established in the Mills building, situated conveniently near the Navy Department building. This furnished quarters for the Naval Intelligence Office, Hydrographic Office, General Board, office of the admiral, office of the Marine Corps, Naval Pay Office, Board of Inspection and Survey, Naval Examining Board, Naval Retiring Board, Board of Medical Examiners, and Medical Dispensary.

Secretary Long was an ardent friend of civil service reform. At the navy yards he continued and extended the system of appointment devised by Tracy and improved by Herbert. To Long fell the distinction of placing under the labor-rules the office of ship-keeper, the last position in the yards to remain in the hands of the spoilsmen. He also directed that appointments in the navy to the offices of civil engineer, assistant paymaster and professor of mathematics should be made after competitive examinations. In 1902 examinations were prescribed for paymasters' clerks and naval pharmacists.

On March 26, 1897, Long issued regulations governing promotions in the Navy Department, which were prepared by the Civil Service Commission in consultation with the Secretary of the Navy and in conformity to certain amendments to the civil service rules promulgated by President Cleveland on May 6, 1896. These regulations provided for the filling of vacancies in the higher grades of the department by promoting employees from the lower grades. The promoting authorities were to be guided chiefly by certain "records of efficiency," which were to show the character of the services rendered by each employee. In determining his efficiency, the character, quantity and quality of his work and his office habits were to be considered. These records were to be placed in custody of a "board of promotion." It was thought that this plan would largely do away with scholastic tests for promotion, and the exercise of political pressure, favoritism and personal influence. It does not appear, however, that in practice the new system has

[242] Official Register of U. S., 1897 and 1905.

greatly changed the old methods. The Navy Department does not offer an attractive opening to ambitious and capable young men. Their opportunities for advancement are less than in some of the other departments or in civil life. As a result, resignations are frequently tendered by the most useful and wide-awake clerks, and the clerical force of the department lacks stability. Secretary Bonaparte proposed to remedy this defect by establishing a clerical corps of the navy, the members of which were to enjoy the privileges of relative rank and the right of retirement on the same basis as obtains in the other non-combatant corps of the service.[243]

[243] Fourteenth Rept. of Civil Service Comm., 166-169; Ann. Rept. of Sec. of N., 1905, pp. 8-9.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE U. S. S. *INDEPENDENCE:* AN APPRECIATION

By SURGEON A. FARENHOLT, U. S. Navy

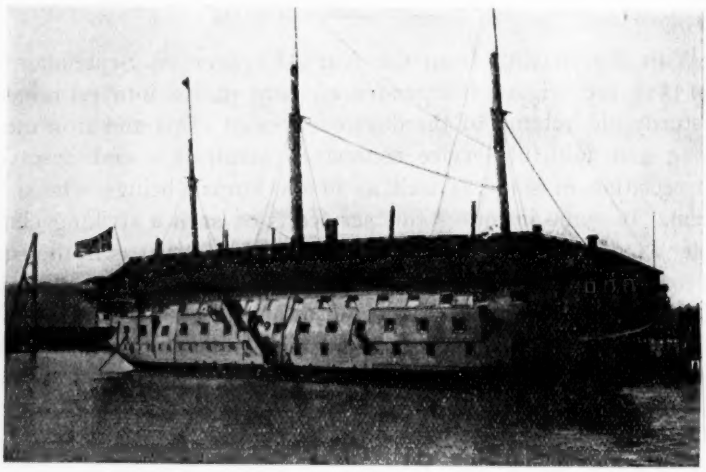
With the striking from the *Navy Register* on September 3, 1913, of the frigate *Independence,* there passes into retirement a sturdy old veteran of the days of wooden ships and iron men. Long and faithful service commands admiration and deserves appreciation in ships as well as in the human beings who man them. In some instances this service is of such a striking character as to win national recognition and admiration, as in the case of our own *Constitution,* the British *Victory* and the French *Vengeur.* In other cases the claim to appreciation and respect is by reason of age, long service and the association of many officers. In the latter class have been our *Independence, Vermont* and *Santee.*

In three respects the *Independence* holds a record. "She was the first two-decked ship that ever went to sea under the American flag." (Cooper.) She has attained the greatest age of any vessel which still retains a large proportion of her original timbers. The only older vessels, the *Constitution* and the *Constellation,* have been so thoroughly overhauled and rebuilt that they cannot claim to be, in any large sense, the same vessels that were launched in 1797. Her third record consists in having remained stationed for duty at one place for a longer period than has been the case with any previous ship in our service. From 1857 to 1912, for 55 years, she remained the receiving ship for Mare Island, California.

Her berth, however, was changed for 15 months, from the navy yard to San Francisco, November, 1867, to February, 1869.

The history of the *Independence* commences with an act of Congress dated January, 1813, when $2,500,000 was voted, against

strong opposition, for the building of four ships of the line and six frigates. With the single exception of the *America*, 74, which was presented to the King of France, Louis XVI, in 1782, never having been in commission in our service, these three line-of-battle ships were the first vessels of that class to be owned by the United States. These vessels were the *Independence*, built at Charlestown, Mass., 1813-1815; the *Washington*, built at Portsmouth, N. H., 1813-1815; and the *Franklin*, built at Philadelphia, 1815. The *Washington* made two cruises, spent most of her time in commission in the Mediterranean as flagship, and was finally broken



"INDEPENDENCE" AS SEEN FROM MARE ISLAND STRAIT

up at New York in 1843. The *Franklin* served as flagship in Europe and was our first large ship in the Pacific, in 1821. She was broken up in 1852.

The keel of the *Independence* was laid in August, 1813, at the Charlestown Navy Yard, by Constructor Edward Hart, and she was launched on July 20, 1814. A previous attempt had been made on June 20, but it had failed, a rather common mishap in our early days.

Emmons records the following data when she was in commission as a 74:

"Guns: 64 long 32-pdr., 20 32-pdr. carronades, 2 (?), total 86; tonnage, 2257; officers and men, 750; cost complete, $421,810; annual expenses:

pay, $101,152; provisions, $40,150; ordnance, $12,000; medicines, $3000; wear and repair, $40,000; contingent, $8000; stores, $15,000; total, $219,302."

The expenditure of $12,000 a year for ordnance shows that target practice was not neglected in those early days, although it is known that strict economy was habitual in all branches. I have been told by an enlisted man who served in the *Independence* in the Pacific in 1855 that the usual target exercises were conducted by firing into a bank or bluff and that as many of the shot as possible were later dug out, washed and carried back to the ship's magazines. There were of course no iron foundries on the west coast in the early days, and this saving was necessary.

Her "total length was 188 feet; beam, 50; hold, 20; ballast, 100 tons; water, 50,000 gallons. Stored and provisioned for a cruise, she drew 24.4 feet of water, leaving the sills of her amidship lower gun-deck ports only 3 feet above water; carried provisions for six months; general qualities reported as good." (Emmons.) Her construction was superintended by Commodore William Bainbridge, the commandant of the Charlestown yard, who was also her first commanding officer.

Five days after the ratification of peace with Great Britain, in 1815, the United States declared war upon the Barbary powers, whose depredations upon our commerce had become intolerable. The first punitive step was the sending to the Mediterranean of a fleet of nineteen vessels, in two divisions, the most powerful naval force assembled by the United States until late in the Civil War.

The first division to get away was that of Commodore Stephen Decatur, who sailed with ten ships from New York, May 20, 1815. Commodore Bainbridge, who was to "assume the chief command on arriving out," was delayed, and left Boston, July 3, with the *Independence* as flagship and with the *United States, Congress, Erie, Saranac, Chippewa, Boxer, Enterprise* and *Lynx* in company. He found upon his arrival in the Mediterranean that Decatur had concluded peace negotiations on June 30, just 40 days after leaving New York. "After making an impression on the different Barbary powers by showing this fresh force off their ports just after Commodore Decatur had left" (Cooper), Bainbridge, leaving Decatur as commander-in-chief, sailed in the *Independence* and arrived at Newport, November 15, and at Bos-

ton, December 7, 1815. While this formidable fleet was assembled at Gibraltar, it was the subject of considerable comment among the British naval officers, who, it was said, had circulated the report that the Americans were not allowed to build line-of-battle ships. Of the 19 vessels then assembled, the *Constellation* is the only one which now remains in commission, and *Constellation* and *Boxer* the only names which are at present on the navy list.

Upon the return of Commodore Bainbridge, the *Independence* was used by him as guard-ship in Boston harbor, flying his flag there until 1819. From 1819 to 1835 she remained at Charlestown Navy Yard, out of commission. In 1836 the ship was razeed, that is, cut down from a flush three-deck line-of-battle ship, 74, to a two-deck razee, 54, with poop and forecastle, *i. e.*, a large frigate, or vessel having but one covered fighting deck. This it was thought would benefit her sailing qualities, as she had previously sat rather deep in the water. The procedure was a common one in the European navies.

On May 21, 1837, the *Independence* left Boston, flying the flag of Commodore J. B. Nicholson, commanded by Captain Alexander Slidell, and carrying the Honorable George Dallas as Minister to Russia. On this trip she established the record for speed across the Atlantic. After leaving Mr. Dallas at Cronstadt and receiving marked social courtesies from the Russian government, she sailed for the "Brazils Station," and finally returned to New York, March 30, 1840.

At this time the ship was reported to "sail best when from 6 to 20 inches by the stern; retaining her original spars, her lower masts are unusually taut. Under favorable circumstances has logged 10 knots on a wind and 13 free, behaves well, is a good sea boat and sails fast, 1837. During her last cruise to the Pacific averaged 140 knots per 24 hours for 400 consecutive days; was beaten by the *St. Lawrence* and *Cumberland* in the Mediterranean; is sure in stays, stiff under canvas, inclined to grip, and is hard on cables, 1849-52; recommended to dispose of 10 tons of ballast, the poop and topgallant forecastle, to shorten lower masts and dispense with tiller on gun deck which interferes with working of stern guns." (Emmons.)

In 1846 the *Independence* sailed from Boston for San Francisco, on which station she remained as flagship of Commodore W. B. Shubrick until her return to Norfolk in 1849. This cruise

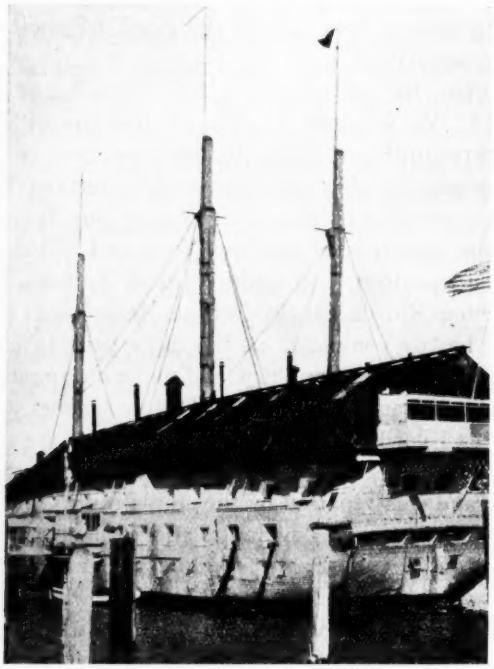
was made during the war with Mexico, and as flagship of our forces in the Pacific she participated in the naval activities, being present at the capture at Guaymas and Mazatlan and capturing two vessels of the enemy on May 16, 1847. While visiting Honolulu, during this cruise (arrived August 12, 1848), the ship unfortunately carried and spread the contagion of measles. The disease is reputed to have caused the death of one-tenth of the entire native population.

In July, 1849, the *Independence* left Norfolk, as flagship of Commodore C. W. Morgan, for the Mediterranean Station, and remained there until her return to the same port in July, 1852. During this cruise the ship was extensively entertained at Spezzia, where she was the first public vessel to show our flag.

In 1854 she was refitted at New York and sailed as flagship of the Pacific squadron, Commodore Josiah Tattnall, flag officer. Before reaching Rio de Janeiro serious defects were discovered in the work hastily completed at the navy yard to expedite her departure, which it was thought would make it dangerous for her to attempt the passage around Cape Horn. Changes were made in her sails and yards, and she safely made the voyage under a jury rig. While in the Bay of Panama, her mainmast was struck by lightning and was repaired by the ship's force; the "fish" put on at that time remains to-day and is an excellent example of the seamanship ability of those days. While at Panama the ship lost a number of men from yellow fever, many of whom were buried with the other naval dead on Flamenco, "Dead Man's Island," near the anchorage.

On October 2, 1857, the *Independence*, with Commodore William Mervine on board, first arrived at Mare Island. On October 28, 1857, the crew of the former receiving ship *Warren* were transferred to the *Independence* and the latter took over her duties. In 1863 the ship was used for a short time as a barracks for the station marines. Later in the same year the spar deck was housed over; this was said to have been done chiefly for the better accommodation of the sick. On November 9, 1867, Captain W. A. Parker commanding, the ship was towed to San Francisco and stationed off Mission Rock, still however remaining the receiving ship for Mare Island, but being temporarily referred to as a school-ship. On February 17, 1869, Commander Paul Shirley commanding, she was towed back to the navy yard at Mare Island.

The *Independence* was the first ship to enter the stone drydock at that place, on October 30, 1886. On November 2, 1912, she was placed out of commission, the *Cleveland* relieving her, but for some months the commodious offices and sick-bay continued to be used by her successor.



"INDEPENDENCE" STERN VIEW, SHOWING "FISH" ON MAIN MAST

Officially the old ship is a relic of the past; it is altogether improbable that she will ever again be employed for any public service. While plans have been formulated by which she may become a museum moored to a wharf at Vallejo, or, fitted and rigged as in her prime, may be used as a naval exhibit recalling the days of '49 at the approaching Panama-Pacific fair in 1915, whatever her few remaining unofficial vicissitudes may be, her public career has closed and the junk man and his torch, the undertakers of the deep, must soon claim her; the shell passes, and her duties are honorably completed.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

TIME ELEMENT IN MANEUVERING

By COMMANDER G. H BURRAGE, U. S. Navy

The time element is such an important factor in maneuvering ships, both from the standpoint of the officer of the deck and from that of the officer directing the maneuver, that the following study of changing front, or course, of a division of ships in line (abreast) has been made in the hope that the data may prove instructive.

Diagram 1 shows the number of yards that have to be steamed on the first change of course (one-half the total change of course) of a division of four ships at 500 yards distance.

Example: for a 30° change of course, or front, the second ship should change course 15° and steam 260 yards, then change course 15° and take up the new course. The fourth ship has to steam 776 yards before the second change of course.

Diagram 1 also shows, for each change of course, or front, the number of yards that each ship must steam in excess of the distance steamed by the guide.

Example: for a change of course, or front, of 45° the second ship must cover 383 yards more than the guide, the fourth ship 1148 yards.

Table 1 gives, in minutes and seconds, the time to steam the number of yards given in Diagram 1, at varying speeds from 1 knot to 20 knots; also, therefore, the time necessary to gain the specified distance on the guide with an excess of speed of a given amount.

For the benefit of officers maneuvering each ship it will be of interest to see the approximate time available for each maneuver.

Example: speed 12 knots, 15° change of front. Table 1 shows that the second ship takes about 18 seconds to cover the 130 yards, and if the reserve speed is 1 knot, 3 minutes and 51 seconds to get into line; while if the reserve speed is 3 knots, it takes but 1 minute and 16 seconds. The fourth ship takes 57 seconds

to steam the 391 yards, and at 3 knots reserve speed, 3 minutes and 51 seconds to complete the maneuver; while at 1 knot reserve speed, it takes 11 minutes and 32 seconds.

It is of great importance that officers directing maneuvers should know the time to complete them, which will be, in the case of changing front, when the last ship arrives in line.

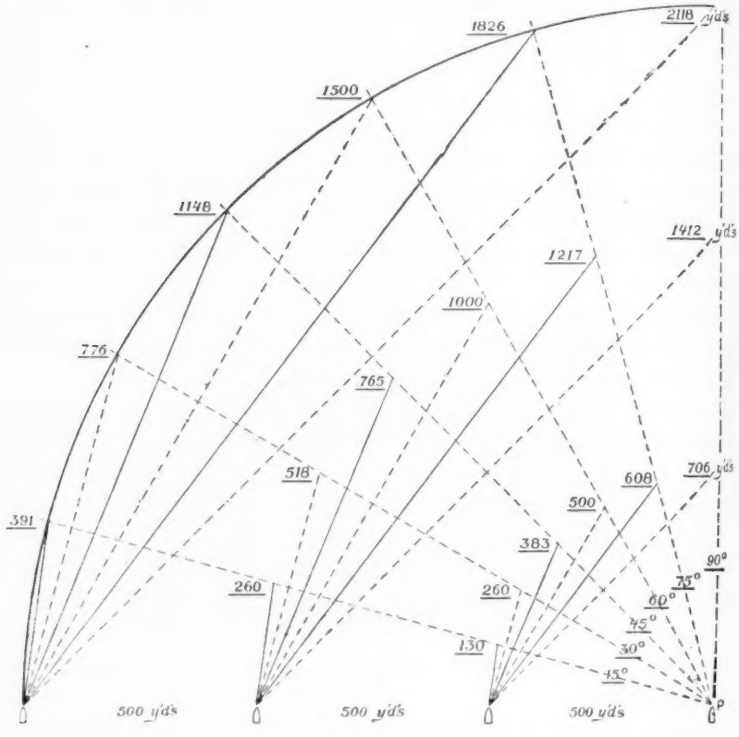


DIAGRAM 1

Change front or course by 15-° 30-° 45-° 60-° 75-° 90°
Giving distance in yards on first change of course (½ total change of course) for a division of 4 ships.

FOR A DIVISION OF 4 SHIPS

AT 1 KNOT RESERVE SPEED

15°	change	of	front	will	take	11	minutes	32	seconds
30°	"	"	"	"	"	22	"	53	"
45°	"	"	"	"	"	33	"	51	"
60°	"	"	"	"	"	44	"	15	"
75°	"	"	"	"	"	53	"	51	"
90°	"	"	"	"	"	62	"	27	"

TABLE I.—FOR DIVISION OF FOUR SHIPS

Knots	Yards																													
	130		260		383		391		500		518		608		706		765		776		1000		1148		1217		1412		1500		1826		2118	
	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.
1	3	51	7	42	11	18	11	32	14	45	15	17	17	56	20	49	22	34	22	53	29	30	33	51	35	54	41	39	44	15	53	51	62	27
2	1	55	3	50	5	39	5	46	7	22	7	39	8	58	10	24	11	17	11	27	14	45	16	55	17	57	20	49	22	07	26	55	31	13
3	1	16	2	32	3	46	3	51	4	54	5	06	5	56	6	56	7	31	7	38	9	49	11	17	11	58	13	53	14	45	17	57	20	49
4			1	54	2	49	2	52	3	41	3	49	4	29	5	12	5	38	5	43	7	22	8	28	8	58	10	24	11	04	13	27	15	37
5			1	32	2	15	2	18	2	57	3	03	3	35	4	09	4	30	4	34	5	54	6	46	7	11	8	19	8	51	10	23	12	29
6			1	16	1	53	1	55	2	27	2	33	2	59	3	28	3	45	3	49	4	54	5	38	5	59	6	56	7	22	8	58	10	24
7			1	06	1	36	1	39	2	06	2	11	2	33	2	58	3	12	3	16	4	12	4	50	5	07	5	57	6	19	7	42	8	55
8					1	24	1	26	1	51	1	54	2	14	2	36	2	48	2	51	3	40	4	14	4	29	5	12	5	30	6	44	7	48
9					1	15	1	17	1	38	1	42	1	59	2	18	2	30	2	32	3	16	3	45	3	59	4	37	5	55	6	59	6	56
10					1	07	1	09	1	28	1	31	1	47	2	05	2	15	2	17	2	59	3	23	3	35	4	09	4	25	5	23	6	14
11					1	01	1	03	1	20	1	23	1	37	1	53	2	02	2	05	2	40	3	05	3	16	3	47	4	01	4	54	5	40
12						56	1	57	1	13	1	15	1	28	1	44	1	52	1	54	2	27	2	49	2	58	3	28	3	41	4	29	5	12
13						52		53	1	07	1	10	1	23	1	35	1	43	1	46	2	16	2	33	2	45	3	12	3	24	4	08	4	48
14						48		49	1	03	1	05	1	16	1	29	1	36	1	37	2	06	2	25	2	34	2	58	3	09	3	50	4	27
15						45		46	1	58	1	01	1	11	1	23	1	30	1	29	1	54	2	15	2	23	2	46	2	57	3	35	4	09
16						42		43		55		57	1	07	1	18	1	24	1	33	1	50	2	07	2	14	2	36	2	45	3	22	3	53
17						39		40		52		54	1	03	1	13	1	19	1	20	1	43	1	59	2	06	2	27	2	36	3	10	3	40
18						37		38		49		51		59	1	09	1	15	1	16	1	37	1	53	1	59	2	18	2	27	2	59	3	28
19						35		36		46		48		56	1	05	1	11	1	12	1	33	1	47	1	53	2	11	2	19	2	47	3	17
20						33		34		44		45		53	1	02	1	07	1	08	1	28	1	41	1	47	2	05	2	12	2	41	3	07

AT 3 KNOTS RESERVE SPEED

15°	change of	front	will	take	3	minutes	51	seconds
30°	"	"	"	"	7	"	38	"
45°	"	"	"	"	11	"	17	"
60°	"	"	"	"	14	"	45	"
75°	"	"	"	"	17	"	57	"
90°	"	"	"	"	20	"	49	"

FOR A FLEET OF 16 SHIPS AT 3 KNOTS RESERVE SPEED

15°	change of	course	will	take	20	minutes	51	seconds
30°	"	"	"	"	1	hour	52	minutes.

By the rectangular method, ships right 90°, column right, ships left 90°, 16 ships will take, at 15 knots, about 21 minutes.

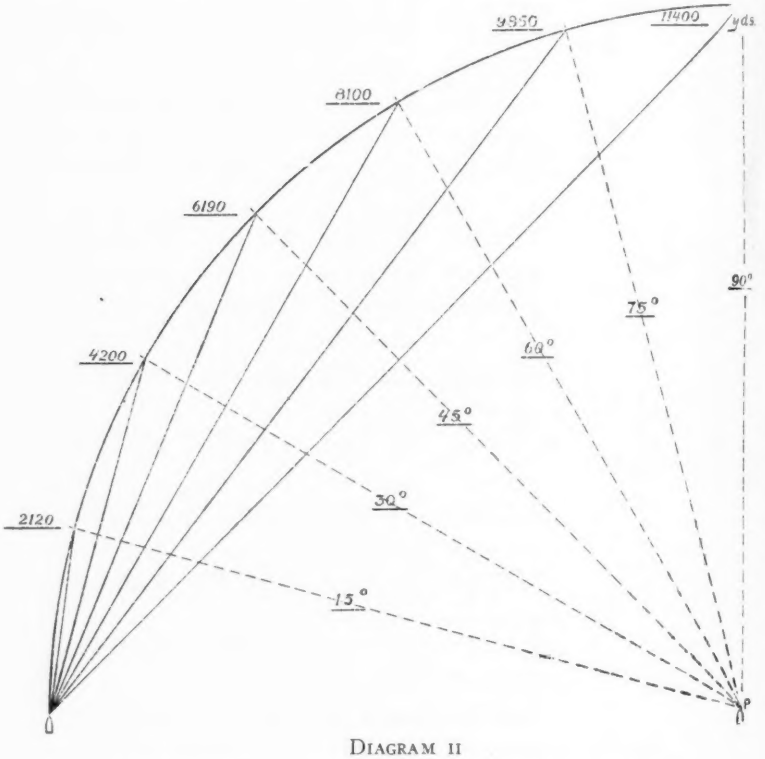


DIAGRAM II

Change front or course by 15-° 30-° 45-° 60-° 75-° 90°
Giving distance in yards on first change of course (½ total change of course) for a fleet of 16 ships

TABLE II.—FOR A FLEET OF SIXTEEN SHIPS

Knots	Yards																	
	2120			4200			6190			8100			9860			11,400		
	h.	*m.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*
1	1	2	32	2	3	54	3	2	30	3	58	57	4	50	52	5	36	18
2		31	16	1	1	57	1	31	18	1	59	28	2	25	26	2	48	07
3		20	51		41	18	1	00	51	1	19	39	1	36	57	1	52	06
4		15	38		30	59		45	39		59	44	1	12	42	1	24	04
5		12	30		24	46		36	31		47	47		58	10	1	07	15
6		10	25		20	39		30	25		39	49		48	28		56	03
7		8	56		17	42		26	04		34	07		41	33		48	02
8		7	49		15	28		22	49		29	46		36	21		42	01
9		6	57		13	45		20	23		26	33		32	19		37	21
10		6	15		12	23		18	15		23	53		29	04		33	37
11		5	41		11	15		16	36		21	43		26	26		30	34
12		5	12		10	19		15	13		19	54		24	14		28	01
13		4	48		9	31		14	01		18	27		22	22		25	52
14		4	28		8	51		13	02		17	02		20	46		24	01
15		4	10		8	15		12	11		15	55		19	23		22	25
16		3	54		7	44		11	24		14	55		18	11		21	00
17		3	40		7	17		10	44		14	03		17	06		19	10
18		3	28		6	52		10	08		13	16		16	09		18	40
19		3	17		6	31		9	36		12	34		15	18		17	42
20		3	07		6	11		9	07		11	56		14	32		16	48

By reducing standard speed to 3 knots, with 15 knots reserve speed, for 16 ships:

90° change of course will take 22 minutes 25 seconds, about the same time as by the rectangular method at 15 knots speed.

By the rectangular method for 16 ships, every change of front takes about 21 minutes; by the other method it will be necessary to reduce the standard speed and at the same time increase the reserve speed, for any change of front of over 15°, in order to keep the time of the completed maneuver about equal to that of the rectangular method.

In any comparison of the two methods, the difference in the amount of sea gained during the progress of the maneuver should be kept in mind.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ADVANTAGES OF THE GYRO COMPASS

By ENSIGNS R. E. BYRD and H. E. SAUNDERS, U. S. Navy

Lieut. Commander Dinger, U. S. N.,[1] and Mr. Gillmor,[2] of the Sperry Gyro Company, have written articles on the "Gyro Compass in Service," which were, of necessity, partly theoretical. The following conclusions were reached from actual experience with the compass on the flagship of the Atlantic fleet.

It was found that the gyro compass greatly lessens the work of the navigator. No compensation of the compass is required other than a shifting of the lubber's ring for a constant deviation, thus doing away with the necessity of swinging ship, with its attendant loss of time and inherent uncertainty.

The true course is shown at all times, so that the troublesome and changing variations and deviations do not have to be reckoned with. The compass is not affected by the training of the turrets or boat cranes, particles of iron near the binnacles, or changing sub-permanent magnetism of the ship. No checking up at the standard compass with the steering compass is required, with a set of deviation tables for each to complicate matters.

For some time to come, the magnetic compass will be used in conjunction with the gyro compass for surety and safety. Only one magnetic compass, however, is needed for this purpose, and the gyro repeaters will probably replace all but the steering magnetic compass—which on the later ships is also the standard compass. With the magnetic compass and the gyro repeater, side by side, it is a most simple thing to get the deviations of the former.

[1] The Sperry Gyroscopic Compass for Naval Vessels, Lieut. Commander H. C. Dinger, U. S. N., p. 845, Whole No. 139, Vol. 37, No. 3, September, 1911.

[2] Theory and operation of the Gyroscope and the Sperry Gyroscopic Compass, Ensign R. E. Gillmor, U. S. N., p. 519, Whole No. 142, Vol. 38, No. 2, June, 1912.

Gyro repeaters used on the wings of the bridge, in the pelorus stands, enable a true bearing to be read directly off the repeater and give a very easy method of checking the repeaters by azimuths of the sun. The steering repeater is in turn checked up by the pelorus repeaters.

When changing course, the gyro compass has absolutely no lag. A deviation from the course of one-fourth of a degree is instantly detected, and thus, no matter how fast the ship is swinging, accurate observations are possible. Also, because of this freedom from lag, a helmsman of long experience is not needed.

There is a continual hunting of the repeater cards of about one-fourth of a degree. The term "hunting," as applied to the gyro compass, refers to a rapid oscillation in the horizontal plane about its axis, of the repeater card. This hunting is not necessary, but it is an excellent thing for two reasons; first: so long as the repeater card is hunting at its usual speed and radius, the officer-of-the-deck can be reasonably certain that the gyro is running satisfactorily; secondly: if the helmsman, using the non-hunting card, keeps on the course for any length of time—and this is not difficult with the gyro compass—it is a peculiarity of human nature that he will turn the wheel to see if the gyro has stopped; and thus in the long run a straighter course can be steered with the hunting repeater card.

This increase in steering accuracy by the gyro is a great help to the flagship or other ship keeping guide in formation.

Considerable has been said, since the advent of the gyro compass in the navy, of the saving in time, distance travelled, and coal consumption that would be effected by its use. These were often mentioned as advantages, in view of the fact that a ship with a gyroscopic compass could steer the straightest and shortest course to its destination and thus make her voyage in the most economical manner.

It is not known, however, that any tests have been made, or that any experiments have been carried out which would tend to show the extent of this saving of time and coal. And it is not probable that convincing and accurate results could be obtained without some such extensive tests by reciprocating-engined and turbine-engined steamers.

With a view to finding out something definite along this line, experiments were carried out on the flagship in the spring of this

year, which serve to show some remarkable facts about the steering of ships of this class.

A device was rigged to make a record of the variation of the ship's head from any given course and the corresponding helm angle being used—the gyro compass giving the standard course without any lag or deviation. Then different helmsmen were allowed to steer the ship, at speeds of from 12 to 15 knots, both with the gyro and with the magnetic compasses, and a record was kept of the performance of the ship with the various rudder angles which they used. The sea was not what might have been called rough at any time during the experiments, so that even the helmsmen admitted that the gyro was not getting a fair test. It is a well-known fact that the magnetic compass will roll and swing with a ship in a seaway, so that had the weather been at all severe, the results would have been far more pronounced.

It was found, as a result of a number of tests, that the average helmsman would use about the same amount of rudder with both compasses, and that he would use it almost as many times; but the applications of right and left rudder, if they might be so called, would be about three times as long with the magnetic compass as with the gyro. It was therefore very easy to see, although not to measure exactly, how much this handling of the rudder was retarding the speed of the ship. By watching the two indicators on the recording device, one could see the helmsman, steering by gyro, "take off his rudder" as soon as the ship would begin to swing back onto her course; then see him, with the magnetic compass, leave it on until the ship had oftentimes swung beyond her course, because the ship would tend to carry the compass card around with it.

One other curious performance was noted, that seemed to explain in a moment the cause of the "set and drift" that has always been a part of navigation. There is, of course, and always will be, a certain set and drift due to currents, winds, and seas, yet it is not necessary that faulty steering should be included in these. It was found, then, that although the helmsmen might be steady on his course according to the compass, this course was far from being the true course indicated by gyro. On the occasion of one two-hour run, with the magnetic compass, the ship, although apparently steady on her course, did not steer at any time within a degree of the true course, and at the end of the next three-quar-

ters of an hour, was steaming along at 15 knots, on a course 2° off from the one which had been set at the beginning of the watch. Such a variation may not appear to be of any consequence in the course of a day's run, yet 2° means one mile off the course in every thirty miles; and certainly represents a useless expenditure of time and coal.

As regards care, any electrician of ordinary knowledge can, if properly instructed, keep the compass in good and accurate working condition.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME SUGGESTIONS IN PRACTICAL NAVIGATION

By LIEUT. COMMANDER A. J. HEPBURN, U. S. N.

With the appearance of the "New Navigation" about fifteen years ago there began a period of increased interest in the technique of that art. The Institute has printed numerous articles devoted to such subjects as arc and tangent methods, azimuth finding, haversine formulæ, Aquino's Tables, and even the humble latitude and longitude factors. Pages with a wealth of long unfamiliar mathematical signs have been written in minute analysis of the relative advantages and disadvantages of different methods of working out sights. All of this work is, without question, excellent. As representing the trend of present-day investigation, however, might it not give rise to the impression that the last refinement of the art of navigation is now being sought in some instantaneous and unlaborious method of working out sights? Such may, indeed, be the case. There is certainly an air about those navigators that have just learned to work Marcq St. Hilaire instead of the time sight. The Naval Examining Board, too, has introduced an examination question of late years requiring the solution of the intersection of two lines of position by computation, which looks as if "practical" navigation were getting hackneyed.

For the benefit of a possibly limited following I urge that some attention be given to those practical problems and those tricks of the trade, as it were, that are still known to mark a difference between navigators, even if the only research needed be to collect the information from its scattered resting-places and put it in handy form. A broad field of utility is offered in the matter of apparatus alone. The attachment of a reading lamp to the sextant was worth more than a new formula for working out the sight. A telescopic alidade is as important in its way as a tele-

scopic sight. A table of vertical angles that did not always have a hiatus in the neighborhood of the exact mountain height required would be a comfort. We have transparent parallel rulers now but the merchant service had them fifteen years ago. While it would be ridiculous to assert that anybody could become lost on the Southern Drill Grounds, a simple machine for grinding out complicated dead reckoning would be soothing to many a navigator. Its construction almost suggests itself. Even a device for keeping the navigator's pencils secure during his temporary absences from the chart-board would have its elements of uplift.

As a modest beginning in this suggested development, or rehabilitation, of the art the following notes are offered.

Let us consider why celestial observations at sea are necessary. There is record of a trans-Atlantic liner having made the passage and having entered her English port in a fog without having obtained a sight, either celestial or terrestrial, during the voyage. Every navigator of experience can recall certain passages when his dead reckoning checked practically perfectly with his fixes. In our speed runs we depend upon engine revolutions to give us the speed to the hundredth part of a knot. Assuming good weather, in these days of large ships, good speed, standardized screws, and gyro compasses it is certain that, except for one cause, our dead-reckoning is accurate within the limits ordinarily accepted as applying to positions by observation. The disturbing element, of course, is current. When we find current where no current is supposed to exist we call it bad steering and compass error. These errors probably have less influence than they are generally credited with, but if they have a constant and measurable tendency their effect is the same as current and they may be regarded as such. It is current, then, that makes us dependent upon observations. It would appear that some quick method of determining the current is one of the most important problems of navigation. Every navigator undoubtedly considers this question in some way and has an individual method of making correct or incorrect allowances for it. He is helpless otherwise, for he gets no practical assistance from the authorities. This is what we find in the Naval Academy textbook on the subject. Starting from the noon fix, and barring star-sights, which seem to be regarded as non-union labor in this connection, the " current in longitude " is discovered next morning and its other component is de-

termined at the succeeding noon. That is, once a day we determine the average current for the preceding twenty-four hours. If we happen to be following the axis of the Gulf Stream we may apply this average current to our dead-reckoning during the following day with some degree of confidence, but, aside from such a special case, the information has lost its usefulness by the time it is required.

An experience of about six years as navigator, and many weary hours as watch-officer spent in plumbing a ship over a deep-sea sounding wire, have convinced me that deep-sea currents have small respect for the current arrows shown on the charts. Vagrant currents are to be met anywhere—well defined flows persisting for only a single hour or for a whole day and rising sometimes to three knots in strength. The variations of even the best-defined currents are such as to cause practically the same phenomenon. These things matter very little to a ship in the open sea, but in coming on the coast at night, in such a poorly-lighted region as the Caribbean, for example, an error of a few miles is of some importance. Any method of measuring, or even of detecting the presence of these currents *at the time of their existence* is obviously worth striving for, and it seems that if the apparent available talent were applied to the problem there should be some hope of a solution. If solved by means of observations, then our sights would show us where we are and whither we are going instead of where we might have been.

The perspicacious reader will immediately perceive that this is but a roundabout way of stating the old problem of getting a fix with one observation. But not exactly. With a little greater precision in our dead-reckoning and not a hopeless improvement in the precision of observations—but including the highly objectionable feature of taking a great many more of them—a partial solution may be found by altering our method of getting intersections of lines of position.

The method suggested hereafter rests upon the assumption of an accuracy in the taking of observations that will be little credited wherever it is not vigorously disputed. By the term accuracy is meant the uniformity of error in observations taken by a practiced observer with the same instrument on the same day under good conditions. Mathematically it can be proved, probably, that there is an infinitesimal chance of the occurrence of such accuracy.

Since it does exist it is waste of time to speculate on the probability of it. It is not doubt on this point that causes the great diffidence I feel in presenting the following "wrinkle," but rather because it is so elementary and simple that hardly any one will be able to read it without a conviction that he has always known and practiced it. There is a natural disinclination to be classed among those "strong on the obvious." If it has already been published it is contained in such obscure publications that the present effort to call attention to it is justified.

In Figure 1, let us assume a vessel steaming East at eight knots. *O* is the noon fix, *A* is the D. R. position at 2 p. m., and *G* a line of position taken at that time. It crosses the course only a mile from the D. R. position. Close enough. Maybe we

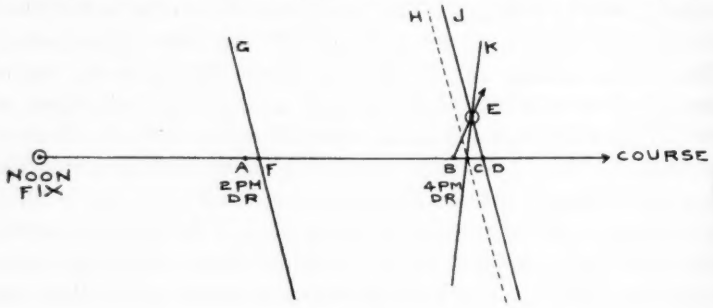


FIG. 1

have a little current with us. At 4 o'clock we take another observation. We get the line *K*, crossing the course at *C*. If we have carried our D. R. from the 2 p. m. D. R. position, our 4 p. m. D. R. position is at *B*. Our line crosses the course still a mile ahead. That, of course, is the same mile we found at 2 o'clock. If there was any current between noon and two o'clock (which, generally it is thought ridiculous to assume just because our 2 o'clock line was one mile out), it has disappeared between 2 and 4 o'clock. So we run our 2 o'clock line up to 4 o'clock (dotted line *H*), and get an intersection at *C*, exactly on the course.

Let us now admit the possibility that some among us are given to error, and assume that these frailer brethren have transferred their D. R. from 2 o'clock on to the point *F*. At 4 o'clock their D. R. position is at *C*. Line *K* passes directly through it and there appears to be no reason for running up our 2 o'clock line.

Now let us start all over again and do some assuming of a different order. In fact we shall assume nothing less than that our D. R. and our observations are both correct.

At 2 o'clock we find we have had a knot of current with us, that is, the current has one component of which both force and direction are known. But the current has another component, probably, and we shall assume its direction as along the line *G*, up or down; its force is unknown. At 4 o'clock our D. R., *carried along from noon*, brings us to *B*. If the current has been steady that component that carried us from *A* to *F* in two hours will have carried us twice as far in four hours, or from *B* to *D*. We know the direction of the other component. We know we are on the line *K*. Therefore, instead of being at *C*—there or or thereabouts—

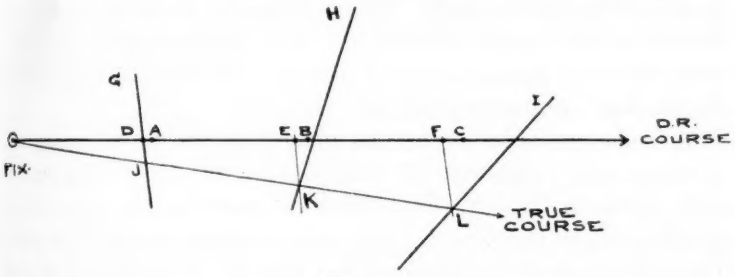


FIG. 2

we are at *E*, and instead of speculating as to the possibility of a quarter-knot or half-knot current along the course we find good reason to believe that we have about nine-tenths of a knot in the direction *BE*,—almost at right angles to the course.

Figure 2 illustrates a few additional features. *A*, *B*, and *C* are hourly D. R. positions from the fix *O*. *G*, *H*, and *I* are position lines observed at these hourly intervals. The one component of the current that we are able to define at *A* amounts to the small distance *AD*—against us. Laying twice this distance off at *B*, and three times at *C*, we get the points *E* and *F*. From *E* we parallel our line *G* and the intersection *K* gives our fix. From *F* again we must parallel our original line *G*, not our later line *H* (unless, of course, we desire to start over again from our later fix *K*), and we get a second fix at *L*. If the current has been steady the points *O*, *K*, and *L* will lie in a straight line. Notice the deceptive aspect of the first two lines in their close agreement

with the D. R. positions. There is apparently nothing in the situation at either *A* or *B*, as judged by ordinary standards, to indicate the advisability of taking another sight within the hour. It is true that if we get an ordinary intersection of line *G* with line *I* we obtain a fix pretty close to the true fix *L*; but if we have neglected taking the first two lines what should we judge from the data presented at *C*? Obviously there is a discrepancy that calls for an accounting, but the indications are as likely to lead to a decision that we have been set ahead as to the truth, viz., that the current is about two knots athwart and a little against us.

Referring again to the statement as to the unsuspected accuracy of sights, I may mention that many times I have obtained a straight line of as many as five intersections in sights taken at about half-hourly intervals. This indicates an absolute constancy of error in that many observations. The absolute error does not affect the exact determination of current. Of course it does affect the absolute accuracy of the fix.

An apparent limitation of the method lies in the necessity of working from a good fix. If we have only three lines of position with course and speed, the problem is indeterminate, because a solution can be obtained for any point assumed in the first line. The opportunity exists, however, for anybody interested to devise an easy graphic method of reconciling the indications given by three or more lines taken in quick succession with a fix obtained many hours before, as, for example, by star-sights. If the current has been steady the solution already given is sufficient, but on account of the sudden variations of current mentioned the device needed is some graphic solution of the *probabilities* in the case. It is apparent, of course, that once having obtained a fix we can maintain it by taking enough observations; but it is very discouraging to have this feature of increased labor always pushing itself into the foreground when all modern tendency is directed towards its elimination.

Another limitation lies in the necessity of good weather both for D. R. and observations. This is hardly a fair criticism in view of the modest improvement claimed for the method since, in bad weather, all signs fail anyhow. Again, a fix obtained from landmarks should not be associated with astronomical observations, on account of the difference in error. Similarly, because of the well-

known discrepancy between a. m. and p. m. sights, some judgment should be used in combining lines of the two periods.

But these are minutiæ that will occur to any one that seriously considers the method. The principle involved is the valuable part of it and this may be briefly stated thus: Work to the utmost accuracy both sights and dead-reckoning and do not assume that discrepancies are due to errors and indeterminate causes. If the work in each case *has* been accurate, the discrepancies are the information we seek and are subject to easy analysis.

It may not be out of place at this point to mention the almost obvious bearing of this principle upon the question of omitting seconds in working navigational sights. In Lieutenant Schuyler's interesting paper on this subject in the December issue of the PROCEEDINGS he gives the following values for the mean errors in ships' positions as determined by an examination of their signaled positions during eleven days.

Noon latitudes	± 1.63 miles
Noon longitude	± 2.77 miles
8 p. m. latitude	± 2.06 miles
8. p. m. longitude	± 2.07 miles

These are errors in *signaled* positions, not in *sights,* except in the case of the noon latitude. Moreover they are errors by different navigators. The errors due to different allowances for current, different times of taking the observations on which they are based, and even different practice in regard to omitting or carrying along the seconds in working out the sights all enter into them. If such errors were to be expected in the sights worked by the same navigator, it is evident that there would be little hope of obtaining the current by the method suggested. I do not know where any data can be found on which to base an estimate of the *uniformity* of error. The illustrations cited hereafter are fairly conclusive as regards those individual cases, and it is an easy matter for anybody to prove it in individual cases for himself. What I suspect is that if every navigator used exactly the same methods of obtaining his current and combining his lines of position the errors quoted by Lieutenant Schuyler would be much reduced. The data on its face rather supports this assumption. Why should the longitude errors exceed the noon latitude error if so small an error is introduced by working to seconds of time?

Why should the 8 p. m. latitude error exceed the noon latitude error except for errors in combining lines of position, or different methods of treating discrepancies between sights and dead-reckoning?

Without some illustration of what practical purpose this method might serve in ordinary sea-going, it would be easy to conclude that we have mistaken a molehill for a mountain. From an experience that includes scores of successful employments of this solution I will therefore offer two that I recall most clearly. The figures are taken from memory after a lapse of several years and are meant to be illustrative only.

In the fall of 1907 or spring of 1908, making passage from Guantanamo to New York in the Dubuque, the course was laid for Diamond Shoals Light Vessel, crossing the Gulf Stream. The weather was clear and the sea smooth, almost ideal for observations. Before reaching the point where, according to the chart, we might have expected to feel the first decided effects of the Stream, I began to take observation at intervals of, perhaps, 75 minutes. The surface temperature made its characteristic rise at practically the exact point indicated by the chart. Everything indicated normal conditions. For several hours thereafter, certainly for a distance of about thirty miles during which we should have been in a current of more than a knot, the observations showed none whatever. When it did come it came with a rush. I increased my observations to about two an hour and made half-hourly determinations of the gradually increasing current to tenths of a knot. The captain was of those that show a helpful interest in the navigator's hobbies, and, after watching with some amusement this unprecedented activity with the sextant, he entered with a spirit of raillery into a guessing contest as to the time and bearing of the first sight of the lightship. The ship was due to enter the circle of visibility just at sunset, and, according to my calculations there was a possibility of several minutes of uncertainty depending upon whether the vessel's masts or the light itself was first sighted. This led me to make a tabulation of predicted times and corresponding bearings, because the current was sweeping athwart the course at a rate that changed our bearing by one degree in about three minutes. That it was no guessing contest is proved by the fact that this prediction was exact—to the minute and to the degree.

The circumstances attending the other occasion I have in mind were such as to illustrate particularly the practical value of the method in addition to its accuracy. As navigator of a division flagship I had laid a course from the Chesapeake Capes for Nantucket Shoals Light Ship. It was good weather with smooth sea, but a trifle hazy by the time we were nearing the vicinity of the Shoals. The latitude and longitude reports from all four vessels of the division plotted very closely together up to and including the noon position just preceding the passage of the light ship, where we were due at about 10 p. m. A few sights taken during the afternoon showed me a current beginning about 4 p. m. and setting to the northward at about a knot and a half. The conditions were much like those in Figure 2, where the lines are deceptive from their apparent close agreement with the D. R. It clouded up in the evening and there was a chance for only one star-sight, the azimuth of which was not greatly different from that of the last sun-sight. At 8 p. m. the course laid from the flagship's position passed just north of the light ship. The other three vessels' positions plotted in a neat little group some five or six miles to the southward, actually indicating a small southerly set since noon. Notwithstanding this three-to-one majority against us the flagship changed course about one-and-a-half points to starboard at 8 o'clock and passed the light ship some two hours later, distant about a mile and a half on the port hand. As I have said the figures are from memory and not to be taken too seriously. My recollection is distinct, however, that from the 8 o'clock position plotted by the other three ships the change of course would have passed the light ship outside the range of visibility in the hazy weather prevailing at the time.

Piloting.—There is a rather widespread impression among officers, younger officers particularly, that the elegant solution of this problem lies in making a thorough preliminary study of the chart and then standing in "by eye." An analysis of the causes for this impression *might* disclose that it is based upon conceptions of the pilots of literature, or upon very superficial observation of professional pilots. Certainly it is antagonistic to that scientific habit of mind toward whose development the government has spent charitably—as we are given to understand nowadays—some twenty thousand dollars per midshipman. There is a brilliancy and finish and ease about the method (when it is successful), that

is very appealing, and those who practice it have a tendency to be amused by the man who lays his course off beforehand and then sticks to it as if it were a railroad track. The weight of reason, however, lies with this less brilliant method. No person's eye is so good in estimating an actual channel as it is in sizing up a chart. If the exact line to be followed be laid down beforehand with all its various turns and courses chosen with reference to all the chart affords in the way of leading marks, ranges, stern bearings, turning points, etc., and if the ship be once put upon this line and kept there a whole host of complications falls away at once. A simple glance ahead or astern tells athwartship set. Knowing the athwartship position the eye may be trusted for a bearing to give a quick determination of the position along the course, and at every instant the exact position of the ship is known with all necessary accuracy. More important still, changes of course are determined ahead of time and are based upon absolute factors instead of being influenced by the look of things at the moment. If a deviation from the predetermined line becomes necessary because of some temporary obstruction, get back on the line as soon as possible even if it is only fifty yards away, and do not be influenced by the fact that the chart shows nothing to choose as between where you are and where you had intended to be. After several such uncorrected variations the advantages of preconsideration may be wiped out and you may be placed in the position of only crossing bridges as you come to them; good philosophy sometimes, but always poor navigation. The practice of changing course just because of the "look of things," with a casual reference to the chart for assurance that "we are all right here," often culminates in a sudden shock to the nervous system and a wild activity with compass, parallel rulers, casts of the lead and other paraphernalia at hand. Nobody ever saw cross-bearings taken and plotted quickly enough to be of real use in an emergency in narrow waters. Their proper function is checking up.

There is not a harbor in the country where five minutes steaming can be saved by making these slight changes of course suggested from time to time by the "look of things" instead of following the best course indicated by the chart. Therefore determine the complete approach to the anchorage on the chart beforehand, and *make* the ship go where you have determined she shall go. This is what professional pilots actually do, however

much they may appear to be influenced by nothing except an intimate familiarity with the bottom. Each of them has a cut-and-dried course of his own which he never departs from without reason, and probably no two of them use exactly the same set of leading and turning marks throughout. Those small changes of course that a pilot makes now and then, apparently with little reason, are to put him exactly on his line.

By following this plan the eye is trained as it never can be when there is no definite criterion by which to measure its inaccuracies. Development of skill requires a definite objective. If the objective be made so broad that it takes account only of getting through pilot waters without accident, the eye will never develop a fine skill in this work. It is as if the bull's eye covered the whole of the target.

Every course in pilot waters should be laid down, first, with reference to the channel, and then prolonged to the edge of the chart, if need be, in minute search for distinctive objects. If there is none on the line others will be discovered that suggest a better course. It is excellent practice also in studying a chart to close the eyes and try to visualize the actual sea and landscape. There will always be occasions enough when a trained eye will be perhaps the only factor of safety.

One-fifth Rule.—One of the handiest bits of information for the navigator to remember is that the sine of one point is equal to one-fifth (exactly 0.19509), and that, for practical purposes, the sine increases as the angle up to two points. With this little tool a great many trips to the chart board can be saved. Its applicability to different cases will widen its use. A single example will suffice.

In coasting it is our distance off shore that is generally in doubt. Our position along the course is known within a mile by a glance at the watch. Suppose we round a point and sight a light fifteen miles distant which we wish to give a berth of one mile. The sine of one point being one-fifth, if we bring the light one point on the bow we shall pass at three miles distance. Ergo, bring it one-third of a point on the bow, or say four degrees. Set the alidade at four degrees on the bow and steady when the light is on. This is more rational and easy than trying to lay off a compass course from an assumed position with a $\pm 1^\circ$ compass error. As we run up on the light, until it gets beyond two points

on the bow, we may stand by the alidade and with a sight, a glance at the watch, and an easy mental calculation, determine the thwartship set almost instantly. Bear in mind, however, that the Captain is also interested in the navigation and may not be an admirer of thumb-rules; so it is perfectly sound policy to do the visible chart work too.

* * * * * * *

A higher *artisanship* in the practice of navigation seems just now the most promising line of endeavor. The naval officer's preliminary training in this science is greatly superior to that of the average officer of the merchant marine, but the latter, because he practices it all his life, has developed a wealth of practical resources, apparatus, thumb-rules, axioms for fog navigation and what not that are not to be found in our textbooks. These minutiæ are the more valuable to naval navigators since, ordinarily, not one officer in a dozen gets enough navigating experience to evolve them for himself.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MORAL TRAINING IN PREPARATION FOR WAR[1]

By CHARLES M. BAKEWELL, PH. D.,
PROFESSOR OF PHILOSOPHY AT YALE UNIVERSITY

It needs no argument to prove that victories are won, not by greater numbers or by the possession of superior engines of war, but rather by the character and training of the men. It requires no argument to prove that the desired military virtues tend to spread from officer to men by a sort of contagion, whenever the commander, having already acquired respect for his wisdom and practical knowledge of warfare, vividly embodies in his own person the spirit of resolute daring, self-confidence, and the determination to win. Doubts dissolve and obstacles vanish when he appears, and the impossible happens. These things we may take for granted. Every great general bears witness to their truth; every war has written the demonstration in letters of blood.

It is also fortunately true that these virtues are inherent in human nature. Circumstances have indeed brought them to the front in surprising strength without previous extended special training in them. The fact is, they have their origin in deep-seated fundamental instincts, and are not confined to warfare. So perhaps it would be more accurate to say that every one has had more or less unconscious training in them.

But the question arises, may not something be done in advance to prepare for war in this most important matter? Must we wait for the issue to determine fitness to command? Are there no tests that may be applied in times of peace? Is there no practical way of developing and strengthening the will power and resolution of the leader, which are so essential to success? Is there no moral

[1] Lecture delivered at the Summer Conference, 1913, U. S. Naval War College, Newport, R. I.

gymnasium into which all enlisted men may be put to train and toughen their moral muscle; to instill the spirit of self-sacrifice, of self-effacement, for the welfare and efficiency of the organization?

The question before us, moral training in preparation for war, is undoubtedly part of the general problem of training in character. How is any virtue taught? It is a question that was raised ages ago. From the first its peculiar perplexities and its apparently insoluble character were recognized. It was observed that, in comparison with the progress that had been made in art and science, but little advance could be shown with regard to virtue. There were no recognized teachers, no approved methods of instruction. Noble men left behind them ignoble sons—it was the rule rather than the exception. A certain modicum of good behavior could be enforced by law and custom, backed up by the whip of fear. But superior excellence in any respect seemed shrouded in mystery, as if it were a native endowment, a gift of the gods.

The first man to grapple seriously with this problem devotes one of his works to the question of training in the special virtue of warfare. Plato, in one of his inimitable philosophical dramas, the Laches, describes in detail a discussion supposed to have taken place in Athens about 2500 years ago. Two men, obscure sons of famous fathers, blamed their insignificance upon their fathers' neglect of their education, and were earnestly determined that their own sons should never have occasion to reproach them for similar negligence. They have heard of a sophist who has lately come to town and set up as a teacher of the noble art of fighting in armor, an exercise advertised as a cure for cowardice; and they are thinking of putting their sons in this moral gymnasium. Before doing so, however, they go to see an exhibition of this newfangled art, taking with them two of their friends who are at once brave soldiers and distinguished generals, whose opinion as to its value they then seek. The one, General Laches, a blunt old warrior, can see no good in it. If it had any value surely the Lacedemonians, bravest and most war-like of men, would have found it out ere this. Besides, he has encountered these "masters of the fence" in actual service, and taken their measure; no one of them has ever distinguished himself in war. The other, General Nicias, a student of tactics, more open to innovations, and possibly

more credulous, is inclined to think it of value. It will make the athletes of the military profession, will develop an interest in all the arts of war, and will make men more valiant and self-possessed on the field of battle.

The generals being thus of different minds, they call in the philosopher Socrates, who has devoted his life to the study of man, and chiefly to problems of conduct, asking him to help them to a decision. General Laches, while suspicious of talkers, says he will gladly listen to Socrates, for he has seen his bravery nobly stand the test in action, and knows that he is a doer of deeds and no mere speaker of words. Unfortunately I cannot make a similar claim upon your confidence; but in other respects the parallel holds. The general problem we are confronting was put when men first became reflective. The modern sophists' art, which is expected to usher in the virtue of valor, and all other excellences, is not "fighting in armor," but rather, "applied psychology." And I doubt not that I see before me more than one doubting Laches, more than one hopeful Nicias.

It is not my purpose to follow Plato's discussion, but several things are brought out by him that we would do well to bear in mind, namely: that the first condition of discovering means to develop any human excellence is to get as clear and definite an idea as possible of what it is we are after; that the virtue required of the soldier is not peculiar to military pursuits, but is found as well in the humbler walks of life; that it is not a virtue that stands by itself; and that, while from one point of view it seems to be an instinct, a sort of gift, from another it is seen to involve an appreciative knowledge of what is distinctly worth while.

Now it often happens that those who in their lives best embody a given virtue are least able to give a definite account of it, or to tell whence or how it comes. Their ideas about it are vague and inconsistent, and they are apt to regard it as an inexplicable gift. You have it or you haven't; you are the right sort, or you are not. But, at least, the gifts in question are qualities of mind, and it is the business of the student of the mind to analyze and define them, and, so far as possible, trace them to their sources. And so I fortify my modesty under cover of the Athenian precedent in presuming to discuss moral preparation for war with you who are experts, who, in varying measure, embody the thing I am talking about.

Let me first of all enter a disclaimer. I have not come to point out any royal road to the military virtues. No virtue, however slight, can be acquired by any simple device. No new wisdom has suddenly descended upon our psychological laboratories to displace the long teaching of experience. From having an excessive and unwarranted distrust of psychology, men are now swinging to the other extreme and are inclined to show an equally unwarranted trust in it. They are apt to turn to psychology for receipts and cures, somewhat as the sick man turns to patent medicine. It is part of a general failing of our time, the desire to get our results without first earning them. I conceive of the rôle of psychology much more modestly. But I do think that it is possible, in the light of modern psychology, to get a much more definite conception of what it is that we are seeking to accomplish, and are actually accomplishing, by methods now in use, and in the light of that knowledge to modify and improve upon those methods.

It is important to recognize at the outset this fact, which men have been slow in admitting. Conduct is, to a very limited extent, controlled by purely intellectual considerations. It is quite as true to say that the intellect follows the will, as that the will follows the intellect. Both statements are one sided. The fact is, the motive power of action lies more deeply rooted in certain elemental instincts and emotions which outlive all our theories of conduct. It is, for example, a well-known fact that one may be a good reasoner who has never heard of logic, and one who knows all the rules of the game may yet be caught in all the fallacies of argument. And, similarly, one may be well versed in all the theories of conduct that have ever been held, and may have reached some formulation which he deems absolutely valid, and yet in his conduct break all the moral laws, including those of his own professed code. Such an one has simply failed to connect his views about conduct with that underlying dynamic which consists of his elemental emotions and instincts. I do not mean to imply that the theory of conduct is of no value in determining action. On the contrary it is of the greatest value, provided the root of the matter is in you. It is our only means of escape from the thralldom of convention and tradition. I only insist that by itself it is of no value. As Emerson put it: "Intellectual tasting of life will never supersede muscular activity."

It is important to emphasize this fact if we are to consider the question of moral training for war. For, if it be true, it follows that the only training in conduct that is to be effective must involve at once the stimulation and discipline of these fundamental emotions and instincts.

Military writers differ as to the extent to which in case of actual attack the United States would be able to convert its potential military resources into actual power. I find one writer speaking with pride of the surprising rapidity with which, through drill and discipline and persistent work, a raw recruit, provided he possesses certain initial virtues which are fairly common, can be transformed into an efficient soldier. Another can hardly find adequate words of scorn to characterize the blind optimism which leads us to suppose that any save the long-serviced men could hold their own against seasoned troops. He writes: "Science to-day has reached that point in the conduct of war wherein the use of volunteers or militia as against regular troops has become impossible." And he can see no hope except in conscription. But on one point there is no difference of opinion, or room for any. The need for thorough discipline and *esprit de corps* has been made vastly more important than ever before by the complicated instruments of modern warfare.

Now the question which I raise is this: what is it, psychologically speaking, that we seek to accomplish by drill and discipline and persistent effort? It is of course obvious that certain incidental benefits will accrue in the way of increased power of endurance, physical health, temperance and self-restraint, obedience to constituted authority. But back of all these, and giving them their enduring power in the stress of conflict, lies the true effect which we are seeking to produce, namely, a thorough disciplining of the emotions, a certain set of the whole dynamic emotional life of the soldier.

It is a mistake to regard the value of discipline and drill as merely fixing certain habits of thought, or habits of reaction to a given stimulus. The result cannot be described in terms of afferent impulse and efferent discharge. For in the dread reality of battle the impulse which is to bring the desired behavior is crowded by countless conflicting impulses which would of themselves bring very different response. What is it that makes the one small voice prevail? No mechanical interpretation of cause

and effect in terms of nervous energy avails to explain the fact.

We can, if we please, give the resulting situation a high sounding name, and describe it in the words of one author by saying that the individual has attached "his own transitory and changeful characteristics to elemental forces, forces that are immutable to all but endless eons of time." We may say that he has in all literalness merged his being in the over-individual life which is that of the collectivity. Or, that he has heard the call of duty, and, as Kant truly, and finely, puts it: "The pure idea of duty, unmixed with any foreign ingredient of sensuous desire . . . . influences the heart of man much more powerfully through his reason . . . . than do all the motives which have their source in experience." Or, we may simply speak of the awakening of a sense of loyalty and patriotism.

These are literary phrases, and I have no quarrel with them. They are rhetorically effective. But if you will look sharp you will see that behind them all lies the intent to reach that emotional undercurrent of life, which supplies the energy of action, gives body to the idea and form to the will; and to give that energy definite direction. The army, the crew, must have but one mind. True. But this mind is to be embodied in the leader *and also in his command*. The individual soldier of modern warfare has been likened to a cog in a machine. And it is true that, as compared with the soldiers of former times, he has but limited, almost negligible, room for individual initiative. But the phrase is unfortunate. A modern army is not a perfect organization unless every individual unit, every "cog in the machine," does his appointed task as if the whole issue of the engagement hung upon its perfect execution, and does it therefore in a spirit which cries to the mind of the leader. "My will is mine, to make it thine." The over-individual will, to use Professor Münsterberg's phrase, is his own will. He has merged his being in that of the command, and this means that the whole dynamic of his emotional life has been so trained and disciplined that it is spontaneously discharged in the interest of the community, and not, as originally and by a primitive and instinctive reaction, in the service of some narrower and more selfish end.

These are not mysteries. They are patent facts. They are illustrated not only in warfare but wherever training is sought through drill and discipline. Very strikingly do they appear in

all of the major athletic sports. There, too, the insistent drill and discipline and hard routine are of value not primarily as developing skill or muscle, or making of certain reactions a second nature; but rather, again, as training the emotion, giving a certain set to the emotional dynamic of the player so that he may never give up, however weary or discouraged, may efface himself in the team, and spontaneously expend all his energies in performing its task.

We may find, I think, a further confirmation of the position I am maintaining in the actual procedure of the born commander. His last words to his men, when the hour of engagement comes, and the suggestibility of the group is at a maximum, are ringing phrases, like the famous "England expects every man to do his duty," which neither bear nor call for close analysis, but which are effective in proportion as they succeed in fixing securely the result of long training and drill in the discipline of the emotions. Psychology here, as elsewhere, merely backs up, and interprets, and in that way may help to improve the teaching of experience.

But let us come to closer quarters with the psychology of our problem, that I may not be accused of hiding in the uncertainties of literary phrases. I have insisted that the effect of drill and discipline is primarily the establishment of a certain set or direction of the entire emotional dynamic of life. I have not dealt with the emotions separately. In point of fact, in our present state of development, they are very closely, almost inextricably intertwined. But in order that we may see how the desired result is effected, and precisely what it implies, it will be well to consider more in detail several of the emotions which are more obviously concerned.

The simpler emotions[2] are the inner or "affective" aspect of instinct. For example, corresponding to the instinct to run or hide or shudder, is the emotion of fear; to the instinct of pugnacity, the emotion of anger; to the instinct of self-assertion, of self-display, the emotion of elation, or the positive self-feeling; to the parental instinct the tender emotion, and so on. The emotions I have enumerated are those which are most directly con-

[2] v. William MacDougall, Social Psychology, p. 47 *et passim*. I follow this writer in his interpretation of emotion and instinct, and in his classification of the emotions, but he must not be held responsible for the applications I have made.

cerned in the military virtues. No one of them is in itself discreditable, any more than the instincts to which they correspond, all of which have played a necessary part in evolution, and still play a necessary part in daily life.

But three things are noticeable in the case of every one of them: (1) The emotion tends to spread far beyond the range of the objects which originally gave rise to the instinctive reactions connected with them. In some cases also, notably in the case of fear, many of the objects which originally gave rise to those reactions have ceased altogether to have that effect. (2) They all tend to survive when the instinctive reactions no longer occur, or appear only in a rudimentary, incipient, or inchoate fashion. (3) They have all undergone in the course of evolution a discipline that has tended to make them more and more over-personal. Sometimes the process has gone so far as to make them seem altogether impersonal. From being connected in the first instance with those activities which originally meant the survival or welfare of the individual or the family clan, they are now concerned with those which are necessary for the survival or welfare of a nation, or of a cause. We may express this otherwise by saying that the self in whose interest the emotional energy is spent has become identified with the national self or with the cause. When, and in so far as this is accomplished, selfishness has given way to loyalty.

For example, let us consider the case of fear. This was probably one of the earliest emotions to appear, for it extends far down in the animal scale, and it has undergone in the course of evolution the most striking development. Most of the occasions which formerly gave rise to this emotion have ceased altogether to do so, for familiarity with the objects in question and increasing knowledge have taught us that they are not sources of danger. Or, when they are, experience and science have taught us how to cope with them and avoid the dangerous consequences. But if knowledge has restricted the scope of fearful objects, it has also in other directions greatly increased it, for it has taught us where real dangers lurk which we have not yet succeeded in mastering.

But being one of the earliest protective devices of the individual the instinctive fear reaction is also one of the most clumsy and ineffectual. As Leuba writes:[3] "It meets each and every danger

[3] Am. Jour. Rel. Psych. and Ed. Vol. II, p. 11.

in one and the same manner: it brings about a more or less accentuated paralysis of the whole voluntary apparatus; it interferes with respiration; it produces spasmodic constriction of the blood vessels, shiverings, violent spasms of the heart, resulting in pallor and peripheral anæmia. These psychological constituents of the reaction have undoubtedly their direct or indirect value: the immobility which they enforce would, for instance, often be the wisest behavior for the threatened man or animal. But, in the case of a being able, as man is, to observe, understand and foresee, a uniform reaction, the essence of which is a lowering of vitality, a paralysis of the mind as well as of the body, is far from meeting the situation in the best way conceivable to them." It is a mistake, however, to hold that the emotion of fear disappears when one has discovered the stupidity of the instinctive fear reaction, and has ceased to respond in that way.

But finally the emotion of fear has also extended far beyond the range of objects that mean personal bodily harm. Danger to one's country, or to a cause, may also bring it into being. And whenever the individual has identified himself with these things, then the fear of being false to them crowds out all paltry fears for personal safety.

So again the instinct of pugnacity, that great reservoir of human energy, with its attendant emotion, anger, has undergone a similar development. This emotion is peculiar in that it is not so much directed, as the other emotions are, toward certain specific objects, but rather toward any obstacles that stand in the way of the free play of our activities. It is, therefore, as it were, an emotion whose business it is to back up and defend the other emotions. But just because of this fact, it has undergone a development analogous to that of the other emotions. The initial instinctive reaction, the curling of the lip, snarling, and the immediate blow, have given way to more enlightened methods of response, but the emotion persists. And it has also like all other emotions tended to become super-personal, to withstand what interferes with the free play of the national life, or the advancement of a cause. That is, it comes to be directed not against personal enemies, but against enemies of the group, the country or the cause.

It may have seemed strange that I should include amongst the instincts and emotions specially concerned with warfare the

parental instinct and the tender emotion. But as a matter of fact this is the most important of them all, and the one most directly concerned. We note, in the first place, a development here which corresponds to that of the other emotions. First aroused by the cries of one's children, it is later extended to all helpless things, and finally to one's country or cause when they, too, in distress, cry aloud for help. This emotion is most closely allied with anger and is, as McDougall rightly holds, of great importance for understanding "the social life of man, and the right understanding of it is fundamental for a true theory of moral sentiments; for the anger evoked in this way is the germ of all moral indignation." It is in this alliance that we discover the source of that disinterested anger or moral indignation, which is the great inspirer of the spirit of self-sacrifice.

In the same way the instinct of self-assertion loses in course of time its earlier forms of reaction, strutting, boasting, and vain glory; and its attendant emotion of elation gets transformed into a sort of super-personal emotion, extends to other objects, seeks the approval not of inferiors but of superiors, of the communal self, and therein pride gives way to self-reverence.

The point which I would make in this discussion of the emotions is simply this: the long drill and training of experience throughout the course of evolution has resulted in a disciplining of the emotions. Its work has been, as all nature's processes are, halting, imperfect and wasteful. But the trend has been in one direction, namely, toward the identification of the individual life with the life of the community, the individual coming to regard, in some measure or degree, his own true and objective self as the social self, and thereafter spontaneously and unreflectively spending his energies in its service. The intelligently supervised drill and discipline of education should, from earliest youth, fall in with this natural process and help it along. In the last analysis it is the chief source of strength of character and will power. Unfortunately in our present state of education this task is but ill performed. The training and the drill of the man in the army or the navy has no other motive and no other purpose.

But just as training for war involves accentuating and accelerating these natural tendencies of racial development, so it is also true that war itself has been one of the most potent factors in teaching the world this lesson. As James writes: "Ages ago,

war was the gory cradle of mankind, the grim-featured nurse that alone could train our savage progenitors into some semblance of social virtue, teach them to be faithful to one another, and force them to sink their selfishness in wider tribal ends. War still excels in this prerogative."

The question will perhaps be raised, supposing my analysis to be true, of what practical use is it in meeting our specific problem. Can we draw any lessons from these facts? Certainly nothing startlingly novel or revolutionary. But I do think that a clear understanding of what it is that we are actually seeking to accomplish through the methods now in use, and an appreciation of the fact that by our drill and discipline we are simply falling in with natural tendencies and may therefore hope to succeed, will have some value in giving greater confidence in those methods, greater zeal in their employment, more wisdom in their perfecting. Moreover, since the essence of this disciplining of the emotions consists in making vivid a realizing sense of one's unity with the organization in which he serves, we can see from this fact alone why all of those outward signs and symbols of this unity, the uniform, precedence, and the prestige of rank, must be religiously respected.

In one other respect this analysis might perhaps have a slight practical value. Of the emotions that we have considered, which are those specially involved in the life of the soldier, there is one, namely fear, that, if recurring in primitive form, is purely obstructive. This primitive paralyzing fear reaction is likely to ensue in the unfamiliar din of battle, and one may at least in some measure minimize this unnecessary cause of disturbance by familiarizing soldiers with the same sounds. Moreover, one may perhaps, to some extent, drive home the sheer stupidity of this instinctive fear reaction, and thus do something to head it off. It would seem as if, in the case of the navy, where the men are in all literalness in the same boat, this might be a lesson more easily enforced.

But the only effective way to banish an ignoble fear is to put a noble fear in its place, for the fear of personal harm substitute the fear of cowardice. Or better still, since this is the dangerous emotion, the one likely to disturb our reckonings, see to it that one is so absorbed in his particular occupation, or so possessed by the other and ennobling, *i. e.*, better trained, emotions, that no

room is left for the baser fear to enter. It is a true and sound principle of all training in conduct that the undesirable is rarely gotten rid of by being the object of direct attack. The effective way of getting rid of the undesirable is to substitute the desirable in its stead and center interest and attention in it. It then will crowd out all other things. As a friend of mine once said, "When the sun rises in the morning it does not have to go around and snuff out the stars; they vanish of themselves." At the bottom of this discipline of the emotions is the awakening of self-reverence (which is, as we have seen, the developed and disciplined instinct of self-assertion and its attendant emotion of elation), to which one has arisen whenever he succeeds in identifying himself with the community, and thereby discovering a self worthy of reverence. It is a mistaken psychology of conduct which supposes that men are determined in their deeds by a calculus of pleasures. It is equally a mistake to suppose that they are determined by abstract ideas of duty or of nature or of self. The thing that determines conduct goes much deeper, reaches the whole underlying emotional current of life. In imagination one sees one's self doing or refraining from doing the thing in question, and approving or disapproving of the kind of a man that would so act.

But it may be said that what I have been defining as the result of drill and discipline is, after all, certain qualities of the mind. Modern psychology as one of its most striking achievements has brought out the fact of the intimate relation between mind and body. Is it not possible to make use of this principle to help us to more definite practical results? This much at least is clear in view of this relation, that anything which tends to develop health and strength and powers of physical endurance, and thereby give tone to the whole nervous system, will prepare the way for more definite and effective and immediate emotional response when the emotions are once properly trained. Further than this, however, we can hardly go. We must be cautious and not enter upon disputed ground. Although we know that there is no psychosis without its neurosis, and although we may infer that with a given psychosis a given neurosis will always be found, it is a far step from this to the assumption that the nerves or the cells make the man. If we should ever reach that conclusion I imagine that, far from helping the officer in his task, the spread of knowledge of that sort would make his task impossible. Tell a soldier that

he is nothing but nervous mechanism, and, if he believes you, and is wise, the inference which he would draw would be, why all this bother about the community interest, self-sacrifice and self-effacement. From this point of view there would be no gainsaying the wisdom of our American humorist, who wrote: "Have a good time while you are young, for you will be a long time dead." The Epicureans dispelled the dread of death in this fashion, but history shows no record of a successful Epicurean army. It was rather the Stoics who made the warriors, and they dispelled the dread of death by making men believe that it was their high prerogative to side with destiny, and themselves will the universal will. They could then afford to be indifferent to anything that befell this petty body, either pain or death. The fact is that morality lies deeper than any metaphysics yet formulated. It outlives them all. I do not wish to belittle metaphysics, but I only insist that logic never yet turned a coward into a brave man, and if we give the palm to Stoicism rather than to Epicureanism for making soldiers, it was rather because, after all, their formulation of the moral law merely made explicit precisely that training and discipline of the emotional life which I have been trying to define.

The psychological interpretation which I have given above of drill, and of its relation to the morale of the troops, applies alike to officers and to men, but there is this vast difference. Men of the crew, the soldiers in the ranks, have each his appointed narrowly restricted task. Each one has a limited range of initiative, and, wholly absorbed in his special task, consciousness is at a minimum. With the officer this is not the case. He is one of the group, one with it in all literalness. But at the same time as its directing mind he must stand above it. On him rests the responsibility not of performing a specific task, but of the success or failure of the engagement, and of the lives in his command. There is no calling which more than his calls for all the high qualities of man, physical, mental and moral. In war man shows himself at his highest pitch of reality. In the commanding officer, as the self-conscious directing mind of the group, Providence itself, for the time being, is impersonated for the men under his command. In him the emotion of fear must have been transmuted into awe and reverence and a sense of the sublime. It is of the first importance that he should be deeply imbued with the spirit of his high calling, and glory in it.

To map out a course of training for him would be to map out a training in all the human excellences. Nothing should be omitted. All that makes for bodily health, for strong nerves, for physical and mental energy, for deep emotion trained and disciplined through drill, for will power and resolution, for knowledge of his profession, and for that wider knowledge which gives the larger outlook upon life and brings that poise of mind that comes from a clear perception of values in their relative perspective—all this should be included. But it needs no psychologist to call attention to these things. What is asked of him is simply this: has psychology anything to say of the training which will help the officer to meet the crisis when it comes with wisdom, with firmness, and with resolution.

Here, as before, the province of psychology is a modest one. Experience has already taught the ways of getting at the most essential things. But there are, it seems to me, three lessons to be learned from psychology.

In the first place much has been done in recent times in the study of the psychology of the crowd, which it is of the utmost importance for the officer to be thoroughly familiar with. He must be keenly aware of the sources of strength that lie in the existence of the collective and suggestible mind of the group, and also of its terrible lurking dangers. And he must train himself in power of dealing with the collective mind, of controlling it and imposing his will upon it. But this ground was thoroughly and ably covered by Professor Münsterberg in his address[1] here last year and I need not dwell further upon it.

The other matters are more difficult to reach. They concern not the execution of a decision, once it has been reached, but rather the reaching of the decision, and resolutely adhering to it.

The great officer, like the great man of action in any sphere, is characterized pre-eminently by the fact that he is cautious when there seems to be every reason to be sure, and sure when there seems to be every reason to doubt. In a word he is the man who is certain in the midst of uncertainties, and uncertain in the midst of certainties. Such an one inspires the confidence of those under him, and accomplishes wonders.

It is evident that the most essential condition here is a profound and thorough knowledge of the matter in hand, in this case of naval

[1] Printed in the North Am. Review, February, 1913.

warfare. This is not something that can be simply acquired from books. Here, as elsewhere, knowledge is not achieved until it has been won through actual performance. It was in recognition of this fact that this school was established. It is the laboratory method applied to naval warfare, and the value of such training cannot be overestimated. Here, too, practical wisdom has of itself found the way without any advice from the psychologist, and the professional psychologist can only approve of what has been done. Familiarity with actual problems that arise, and knowledge gained through experience of the way to meet this problem with that solution, will no doubt supply an acquaintance in advance with many situations that are likely to arise in actual warfare. And this familiarity will lead to prompt and sure decision, and give the spirit of resolution to the commander.

But in spite of all this preparation, the unexpected and unprepared for situation is sure, sooner or later, to arise. Spring the unexpected in the maneuvers, and one can meet it as he would meet an unexpected move of an adversary in a game of chess, calmly and deliberately. For one thing we cannot reproduce in the sham battle, and that is the element of real danger, and the sense of the terrible consequences of a mistake. And it is precisely these things which, in an actual engagement, are most likely to inhibit the will and induce irresolution.

Can the psychologist show how anything can be done to reproduce this condition, and to train men through familiarity with it? Well, here is my suggestion, and I offer it in all modesty. Without in the least belittling the training given in actual maneuvers, nay, recognizing that you have in it the big thing, what I have to suggest is offered merely as in some slight measure supplementing that work where it is confessedly weak. One must return continually from this training in maneuvers to the study of naval history, to the records of actual engagements. *But he must do this in a special spirit.* It is not in order to find out how on such and such an occasion this or that problem was met. One must approach it in no such detached contemplative and purely intellectual fashion. Take part in the engagement, stand with the officer on the bridge, feel all the uncertainties that crowd upon him, all the awful responsibilities of his command, and thereby add his experience to your own. As in a novel you may be carried away and moved to tears by the pathos of the

tale, so let the story of these actual engagements grip you. These were no games; lives hung in the balance; the decisions were momentous. It is possible to cultivate deliberately this vividness of imagination, and imagination is the gift whereby we may get vicariously the experience of others.

And finally, with regard to that supreme quality of the commander, his ability in the midst of distractions with coolness and wisdom to size up a situation at a glance, promptly to decide, and unwaveringly to hold to the decision—that will power and resolution which constitute his chief strength. Here, if anywhere, the great commander is born and not made. There are no doubt individual differences of temperament which must be reckoned with in determining fitness to command, as well as differences in this mental capacity to promptly estimate a situation, taking in at one sweeping glance the relative weight that is to be assigned to the several factors. The most that psychology can hope to do is to lay down a few simple rules for guidance and self-training, rules which in themselves may seem trivial, and which are certainly without any value in developing will power unless the foundation has been thoroughly and securely laid in that training and discipline of the emotions to which I have already referred.

Now modern psychology has certainly made much more complete the analysis of the phenomena of volition. We know that as Professor James so often insists, the will is essentially a relation between the mind and its ideas, and all volitional effort is at bottom an effort of the attention. Hold fast to an idea, keep resolutely affirming it, let nothing else creep in to displace it, and it will gain sole and undisputed possession of the field, will draw after it those ideas which are its congeners, and the battle is won. This is always the proper point of attack. As Professor James[5] writes: "Consent to the idea's undivided presence, this is effort's sole achievement. Its only function is to get this feeling of consent into the mind. And for this there is but one way. The idea to be consented to must be kept from flickering and going out. It must be held steadily before the mind until it fills the mind. Such filling of the mind by an idea, with its congruous associates, is consent to the idea and to the fact which the idea represents. If the idea be that, or include that, of bodily movement of

[5] William James: Psychology. Briefer Course, p. 451 ff.

our own, then we call the consent thus laboriously gained a motor volition. For Nature here "backs" us instantaneously and follows up our inward willingness by outward changes on her own part." The most effective way of accomplishing this is not to spend one's effort in refusing to admit the wrong idea, but, giving it positive form, clinging to the right one. Professor James's analysis is sound.

But let anyone try to translate it into a rule for practical guidance. He will soon discover that there is such a thing as what might be called intellectual assent to an idea which, however persistently repeated, fails to influence conduct. In other words, the mere idea has, by itself considered, small motive power. We are forced continually to seek that motive power deeper in that same dynamic of the instinctive and emotional life. If, as I have been trying to show, the training given to it in drill, as well as in the discipline of the evolutionary process itself, has had for its result to give that emotional under-current of life a set and a direction which has led to the identification of the individual and his interests with the larger interests of the group or the cause, then it seems to me that a clearer recognition of this, reducing of it to formulas, may help to guide us in the hour of the crisis. That is to say, the formula itself, in so far as mere idea, has little motive power, but in so far as it is recognized as giving form and meaning and direction to this underlying dynamic power, it will, of itself, when once firmly in the field, unloose that power and prove operative.

Now I have shown that the significance of training of the emotions through drill is to identify the individual with the group on the side of his emotional life, and that as this is effected the individual comes to take an over-personal or an impersonal view of himself, and accordingly to be lost in the interests of the group or of the cause. That is, he tends to find his true objective self, his own life and meaning, in that of the community or organization which he serves. And yet this is not a result reached by reflective consciousness, but simply by the training and discipline of the emotions themselves. And mainly in this way the dynamic power is transferred from the individual to the deed by way of ideas in so far as those ideas involve a vivid representation of himself as acting under the guidance of certain principles and certain rules. The conclusion of the matter then is simply this:

the wisdom of past experience should be summed up so far as this may be possible in certain phrases which in times of cool deliberation we recognize as embodying our best wisdom, and these should be stored in memory so that they can always be called upon in stress of circumstance, and be held before the mind so as to dominate in the face of momentary conflicting tendencies. But one must also learn to embody in similar fashion those formulas which express this set of the emotional life which does indeed involve an actual identification of the individual with the community and the group. This is the most essential and most important part. ("One mind." "The plan of the commander." "The success of the engagement as a whole." "Team work," etc.)

One may sing the praises of war, may point out the fact that all of the sturdy and manly virtues have resulted from the wars that have been fought and that if we were to lose the war spirit and all that goes with it, we should be reduced to a flat, insipid, bovine, worthless existence. As Professor James puts it, "Its (War's) 'horrors' are a cheap price to pay for rescue from the only alternative supposed, of a world of clerks and teachers, of co-education and zo-ophily, of 'consumer's leagues' and associated charities," of industrialism unlimited, and femininism unabashed. No scorn, no hardness, no valor any more! Fie upon such a cattleyard of a planet!

So far as the central essence of this feeling goes, no healthy minded person, it seems to me, can help to some degree partaking of it. Militarism is the great preserver of our ideals of hardihood, and human life with no use for hardihood would be contemptible. Without risks or prizes for the darer, history would be insipid indeed; and there is a type of military character which everyone feels that the race should never cease to breed, for everyone is sensitive to its superiority. The duty is incumbent on mankind, of keeping military characters in stock—of keeping them, if not for use, then as ends in themselves and as pure pieces of perfection—so that Roosevelt's weaklings and mollycoddles may not end by making everything else disappear from the face of nature.[6]

One may, I say, glorify the spirit of war, and insist that it is simply furthering the aim of evolution which through struggle leads to the survival of the fit. But one thing is clear, and that is that in the case of an actual war in any given community, it is not always the fittest who survive but rather those are the very ones who are most likely to fall. This is often seized by the

[6] William James: Memories and Studies, pp. 276-277.

pacificists as if it were an argument in disproof of the militarists' contention. But as a matter of fact, when men of that sort die in battle, their souls go marching on. The greatest source and inspiration to virtue in any community in times of peace is the memory of the dauntless heroism of those who have freely sacrificed themselves to the cause of the country. But the real justification of our ascription of supreme value to war as training in virtue lies not so much after all in these things as rather in this: that war itself is the test not of the virtue of individuals, but rather of the virtue of nations. The nation in which through proper drill and discipline the emotions of the individual citizens have been so trained that they have come to identify their own life, their own powers, with the interests of the cause or the country and to spend themselves in their defence, that nation will triumph and, in triumphing, show its right to triumph.

War strengthens and deepens that sense of unity, without which no nation is great; and on the other hand the nations whose citizens have in largest measure that sense of oneness with the community is best prepared for war. Therefore the problem as to moral preparation for war is not one that you can solve alone. You need the co-operation of the educators generally. Not so much that certain ideas should be instilled into the minds of the youth of the country, as rather that from the first, and continually, the importance of drill and discipline in the training of the emotions shall be recognized.

I cannot better bring this discussion to a close than by adopting the words of a writer,[1] from many of whose conclusions I am forced to dissent:

> All the riches of the world cannot supply national unity nor that perseverance which is unappalled by disaster. Yet unity of action and fearlessness of purpose has never, nor ever will, be lacking in whatever resources are necessary to carry on their conquests.
>
> In a nation ruled by opulence, men and the souls of men are not only the valets of wealth, but the nation itself is obsequious to it. The government pursues its course through a labyrinthine way: the interests of countless individuals are paramount to those of state, and national ambition ceases to exist . . . . When war falls upon such a nation it becomes disunited. In the same myriad-minded manner that it carried on the mercantile projects of peace it attempts the conduct of a war; then disintegration, disaster and destruction ensue.

[1] Homer Lea: "The Valor of Ignorance, pp. 70-71.

On the other hand, in a military power where individuals are considered only as instruments of its greatness, the dreadful intentness of its aims knows no discouragement, the straightforwardness of its progress no hesitation, the terribleness of its energy no fatigue. Neither property nor mankind disturb its calculations. It is systematic, simple in design, relentless in prosecution. Theories of finance carry with them no awe; revenues and commerce it takes as it finds them; millionaires and economists strike no terror to its heart, for the excise and stamp duties it levies are not on material resources, but on the souls and passions and ambitions of men. These resources are exhaustless, and so long as nations conceal these facts from themselves, so long must they suffer and be vanquished and die.

DISCUSSION

Naval Personnel Legislation

(See Page 1607, Whole No. 148, Vol. 39, Dec. 1913)

Lieutenant W. W. Bradley, Jr., U. S. Navy.—As yet there is a decided opposition on the part of the majority of the line officers in the service to any system of promotion by selection. In almost every case, this opposition is caused by the supposed inability of the department to design any system whereby even a reasonable degree of fairness would prevail in the selection of the officers for promotion. In only a very small number of cases have I heard an officer state that he should not be willing to take his chances if he were convinced that an impartial system of selection could be devised.

Of course, it is not at all probable that an entirely impartial method of selection, free from all political and service influences, can be devised, but the condition of the Navy List (for those near the bottom) is becoming such that some method of selection must soon be adopted.

In considering the question of whether or not the present system is the most desirable for the individual, the new conditions brought about by the exceptionally large classes of the present day must not be lost from sight.

Heretofore, with the small classes in the service, it has been possible for almost any officer to reach flag rank (if he could avoid "plucking" and continue in good health) but this condition has now completely changed. Under the present system, it is almost impossible for a boy who enters the Naval Academy, when somewhere near the upper age limit, to reach flag rank. No matter where he graduates, there will probably be a hundred or more officers on the active list who are his seniors in rank but his juniors in age. At the present time there are a large number of young officers who, from this cause, do not see the slightest possibility of ever getting above the grade of captain, even though they may serve until they reach the age limit.

Can it be said that the present system is the best, or that it is even desirable, for such an officer? On the contrary, it acts as a complete and practically insurmountable obstacle to such hopes as he may have for the future. The number of such officers is increasing by leaps every year. Seeing themselves without hope, they are given to remaining in the service simply because they must; to getting out at the first opportunity to make a decent living in civilian life; or to retiring just as soon as the law allows. It is very difficult to believe that the services of such officers are as good as they would be if the prospects for high rank were as bright as they ought to be.

As a matter of fairness and in the best interests of the service, I believe that, with the proper safeguards and restrictions, the path to the flag grades must be opened to all young officers instead of only to those who are sufficiently fortunate to enter the Naval Academy while comparatively young.

As a further point I may say that the road of the enlisted man, from warrant officer to rear admiral, is little better than a myth at the present time, simply because he cannot hope to be commissioned in time to compare favorably in age with the younger graduates from Annapolis. In addition to the fact of large classes, the commissioning of midshipmen immediately upon graduation has greatly aided in making such a thing practically impossible.

The only way to the flag ranks, for the older graduate from the Naval Academy and for the promoted warrant officer, is by a method of selection in which merit and excellent record will lift him above the younger officers ahead of him.

As a compromise, which would seem acceptable to the service, the proposed system of promoting, in the upper grades, one half by selection and one half by seniority should be a good one. The one half by selection would open the road to those unfortunates who are without hope at the present time, and the one half by seniority would assure high rank to those passed over by the selecting authority.

Minimum Navy Yard Manufacturing Costs

(SEE PAGE 1619, WHOLE NO. 148, VOL. 39, DECEMBER, 1913)

ASST. NAVAL CONSTRUCTOR C. A. HARRINGTON, U. S. NAVY.—The subject matter discussed in Naval Constructor Westervelt's article is closely related to that covered in an article by the writer published in the June, 1913, number of the Engineering Magazine entitled, "The Relation of Detailed Planning to the Cost of Production."

There is no doubt but that officers at navy yards have too little intimate knowledge of the individual worker; even at the smallest yard employing say 1000 men, changes in an officer's detail are so frequent that even the slightest acquaintance with the individual is not possible. There are too many conflicting claims and demands on an officer's time to permit his doing effective work in any one direction. There are many contributing causes—the list is too long to enumerate. The main cause of trouble is that we have too many navy yards. This is perhaps a far cry but an analysis of the subject by the interested reader will show its close connection to efficient navy yard organization. There is room for only one navy yard in this country, and the sooner a large yard is started the better. What is needed is a real depot for the fleet where it can and must of necessity be taken care of in a business-like manner. Minimum navy yard costs are possible only with a minimum number of navy yards.

Naval Constructor Westervelt's ideas constitute a step in the proper direction for the improvement of *present* conditions. It may be interesting

for some to know that a private industrial concern in Ohio inspected by the writer employs practically the same methods outlined by Mr. Westervelt. In addition the workmen's history was influenced by his record of lost and broken tools, production of *defective* work, and attendance, three other factors not named by Mr. Westervelt which are essentially necessary in order for any official to be thoroughly acquainted with a workman in black and white. This is the only acquaintance which convinces him in time of necessity. They (the workmen) are more apt at such a time, if memory only is trusted, to forget the bad and only remember the good in their performance. Every honest man abhors a crooked deal, and in the ultimate analysis, Mr. Westervelt's methods may be looked upon as a desire to reduce crooked dealing to a minimum, and substitute therefor what is popularly known as the "square deal."

Progress in navy yards has been, is being, and will be made. The goal is the establishment of one large, efficient yard. This vision may not be apparent to the many until the limit of progress is reached with the present large number of yards.

QUESTIONS AND ANSWERS

QUESTIONS (by an associate member of the Institute):

1. I find the following terms in use in technical literature: aero-hydroplane, hydroplane, flying boat, sea-plane, water-plane, hydro-vol, and aero-boat (the Wright type tested Nov. 8, 1913). What is the distinction among these terms?

2. Are not the following definitions in accordance with best usage? Aeroplane: a flying machine designed to rise from and light upon the earth only. Hydro-aeroplane: a flying machine designed to rise from and light upon either land or water. Hydroplane: a machine designed to rise from, and light upon water, fly through the air, and move on the surface of the water.

3. What is expected of a flying machine that can be stored on board a war vessel? To be launched from the ship and from the water alongside, and to light upon the water alongside, subsequently to be lifted on board? (I understand that the maneuver of lighting upon the deck of a vessel is too delicate and at any rate only practicable in calm weather and sea).

4. Is it contemplated, or are any efforts going forward to base naval dirigibles upon war vessels? As I understand the matter, it is impracticable for an airship to land alongside a war vessel, to be deflated, lifted on board, and regassed for another trip. An airship that accompanies a fleet, or raids across a channel or narrow sea must, in every case, conclude its trip with a return to a home airshed. Yet I notice in PROCEEDINGS of March, 1913, p. 404, that an Italian airship "replenished her supply of gas and oil from the ship *Hercules*"; also that a Zeppelin can land on the water. (Article in *Scientific American*, cited in *Journal of Military Service Institution*, Sept.-Oct., 1913, p. 302).

5. I find the term "radius of action" in its application to airships used in two senses: first, the total distance a ship can travel; second, half the distance, each journey implying a departure from home hangar and return thereto. Is not the second use the proper one?

ANSWERS (supplied by Lieutenant J. H. Towers, U. S. Navy, Senior Aviation Officer, U. S. Naval Aviation Camp):

Aeroplane.—A flying machine designed to rise and alight upon the earth only.

Aero-Hydroplane.—Same as *Hydro-Aeroplane.* A flying machine equipped with pontoon and designed to rise from and alight upon the water only.

Hydroplane.—A boat fitted with water planes which operates upon but which does not rise from the water.

Flying-Boat.—A type of *Hydro-Aeroplane* equipped with a boat instead of a pontoon and designed to rise from and alight upon the water only.

Aero-Boat.—A type of flying boat, distinguishing the Wright type.

Sea-Plane and Water-Plane.—These names apply to types of *Hydro-Aeroplanes* as distinguished by the manufacturers. Sometimes used to distinguish between heavier and more sea-worthy types of *Hydro-Aeroplanes.*

Hydro-Vol.—Unknown term. A flying machine stored on board a war vessel should be capable of being launched from the vessel by same as by a catapult, make a flight for scouting purposes, communicate with ship by wireless if so equipped, return with information, alight alongside of ship and he hoisted aboard.

It is not contemplated to base naval dirigibles upon war vessels.

"Radius of action" as applied to airships means half the distance the airship can travel.

"Cruising radius" signifies the total distance an airship can travel.

BOOK NOTICES

"Practical Uses of the Wave Meter in Wireless Telegraphy." By J. O. Mauborgne, First Lieutenant, 4th U. S. Infantry. Published by McGraw-Hill Book Company, New York. 75 pages. Price $1.00 net.

Radio measurements described in this book are in accordance with the best existing practice, and will be of great value to installers and operators in charge as well as to experimenters. Exception may be taken to the statements on pages 29 and 47 relative to the proper coupling.

S. S. Robison.

"Les Corsaires Dunkerquois et Jean Bart." (II) (1662-1702). Par Henri Malo. 460 pages. Illustrated with 20 old maps and prints.

This is the second volume by the same author dealing with that brilliant futility, the "guerre de course."

Here we may see why—historically speaking—the war of the sea-rover has found so many warm supporters, especially in France.

I think the author has written another remarkable book. It is one of the charms of French historians that they write literature at the same time that they write history. Moreover, we have also the reproduction of delightful old prints and quaintly constructed maps that are, in themselves, a most informing study.

Everywhere is evidenced the most painstaking research through the archives of the period. On the one hand have been avoided the inaccuracies of Richer and Poirier; and on the other, the imaginary happenings of Eugene Sue, that so long passed as coin current, have been relegated to the realms of fiction.

The book deals with the rise of Dunkirk and the exploits of the free-captains of the times. To give an outline of Jean Bart is scarcely necessary. It would be merely usurping the rôle of the cyclopædia. The chief value and interest of the book, to my mind, lies not in the exploits of this renowned corsair, but in the lucid exposition of the "guerre de course," following upon Louis XIV's acquisition of Dunkirk in 1662, and its transformation into a great base for predatory operations.

What the genius of Colbert conceived, that of Vauban made into a mighty achievement. So much in love was the latter with the methods for which he was furnishing an impregnable nest, that he became its warmest advocate to the king.

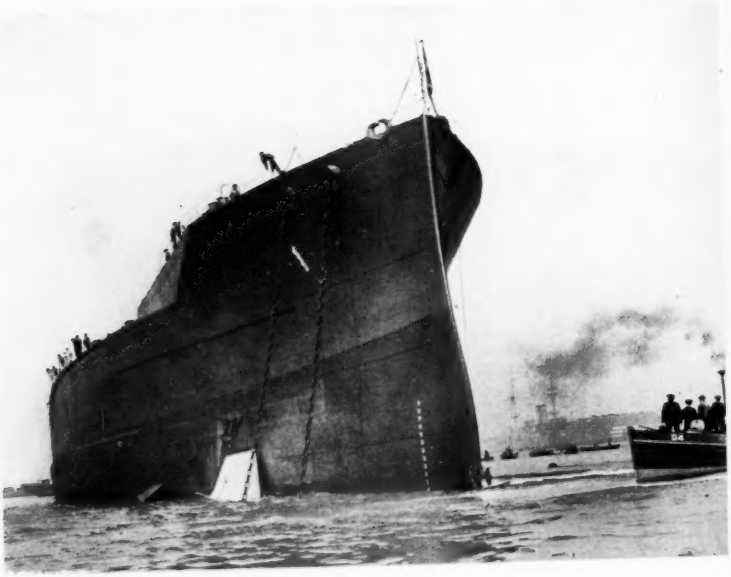
Filled with the exploits of the great Flemish sea-captains, of which Jean Bart was the architype, there is none more thrilling than the description the book gives of the Battle of the Texel.

Jean Bart here reached the most brilliant pinnacle of his career, carrying by boarding eight Dutch men-of-war, with an inferior force, with the added glory of having cut them off while they were attempting to join forces with their allies, the English.

There is a complete index, copious footnotes, an annotated list of plates, an analytical table of contents, and numerous appendices. It is therefore a pleasure as a work of reference.

As a story it is full of absorbing interest to those who love to read of brave men and brave deeds.

A. B. HOFF.



Cribb, Southsea

H. M. S. "Queen Elizabeth"

PROFESSIONAL NOTES

Prepared by LIEUTENANT C. C. GILL, U. S. Navy

GENERAL ARRANGEMENT

A comparison of ships of war, budgets and personnel of naval powers under the following topics:

Vessels building,
Battleships,
Cruisers,
Destroyers,
Submarines,
Auxiliaries,
Personnel,
Naval policy.

	PAGE
NAVAL POWERS:	
Argentine	188
Austria	189
Belgium	192
Brazil	192
Bulgaria	192
Chile	193
China	193
Denmark	193
France	194
Greece	204
Germany	205
Great Britain	212
Italy	225
Japan	233
Norway	234
Portugal	234
Roumania	234
Russia	235
Siam	237
Spain	237
Sweden	238
Turkey	238
United States	240
ORDNANCE AND GUNNERY:	
Guns	248
Powder	254
Projectiles	254
Target Practice	255
AVIATION	261
RADIO	257
STEAM ENGINEERING	268
MISCELLANEOUS	272

SHIPS OF WAR, BUDGETS AND PERSONNEL

WARSHIP TONNAGE OF THE PRINCIPAL NAVAL POWERS

NUMBER AND DISPLACEMENT OF WARSHIPS, BUILT AND BUILDING, OF 1500 OR MORE TONS, AND OF TORPEDO CRAFT OF MORE THAN 50 TONS

Type of Vessel	Great Britain[6] Built No.	Tons	Building No.	Tons (Estimated)	Germany Built No.	Tons	Building No.	Tons (Estimated)
Battleships[1] (dreadnought type)	18	353,350	14	367,500	13	285,670	6	162,300
Battleships[2] (pre-dreadnought)	40	589,385	..	.....	20	242,800	..	.....
Coast-defence vessels[3]	..	.....	..	.....	2	8,168	..	.....
Battle cruisers[4]	9	187,800	1	28,500	4	88,974	3	84,000
Armored cruisers	34	406,800	..	.....	9	94,245	..	.....
Cruisers[5]	72	371,715	20	79,320	40	145,847	4	21,886
Torpedo-boat destroyers	143	104,985	44	42,865	130	67,094	12	7,200
Torpedo-boats	49	11,488	..	.....	...	.....	..	.....
Submarines	72	27,188	22	20,395	24	10,540	12	9,484
Total tons built and total tons building	..	2,052,711	..	538,580	...	943,338	..	284,870
Total tons built and building		2,591,291				1,228,208		

Type of Vessel	United States Built No.	Tons	Building No.	Tons (Estimated)	France Built No.	Tons	Building No.	Tons (Estimated)
Battleships[1] (dreadnought type)	7	162,650	5	144,800	2	46,184	9	214,100
Battleships[2] (pre-dreadnought)	24	335,284	..	.....	18	262,675	..	.....
Coast-defence vessels[3]	4	12,900	..	.....	1	8,800	..	.....
Battle cruisers[4]	..	.....	..	.....	..	.....	..	.....
Armored cruisers	11	149,295	..	.....	20	201,724	..	.....
Cruisers[5]	14	66,410	..	.....	10	49,978	..	.....
Torpedo-boat destroyers	46	29,862	16	17,042	81	34,386	5	3,974
Torpedo-boats	18	3,601	..	.....	139	13,920	..	.....
Submarines	25	.....	7[26]	.....	75	28,224	18	12,190
Total tons built and total tons building	..	760,022	...	161,842	...	645,891	..	230,264
Total tons built and building		921,844				876,155		

Type of Vessel	Japan Built No.	Tons	Building No.	Tons (Estimated)	Russia Built No.	Tons	Building No.	Tons (Estimated)
Battleships[1] (dreadnought type)	2	41,600	4	120,000	..	.....	7	159,395
Battleships[2] (pre-dreadnought)	13	191,380	..	.....	8	112,050	..	.....
Coast-defence vessels[3]	2	9,086	..	.....	2	10,380	..	.....
Battle cruisers[4]	1	27,500	3	82,500	..	.....	4	128,000
Armored cruisers	13	138,483	..	.....	6	63,500	..	.....
Cruisers[5]	14	60,995	..	.....	9	52,845	8	45,000
Torpedo-boat destroyers	54	22,356	2	1,200	93	36,145	45	54,810
Torpedo-boats	28	3,127	..	.....	14	2,132	..	.....
Submarines	13	2,672	2	1,200	30	6,629	25	14,577
Total tons built and total tons building	..	497,199	..	204,900	..	283,681	..	401,692
Total tons built and building		702,099				685,373		

Type of Vessel	Italy Built No.	Tons	Building No.	Tons (Estimated)	Austria Built No.	Tons	Building No.	Tons (Estimated)
Battleships[1] (dreadnought type)	2	40,940	7	172,760	2	40,020	2	40,020
Battleships[2] (pre-dreadnought)	8	96,100	..	.....	6	74,613	..	.....
Coast-defence vessels[3]	.....	.....	..	.....	6	41,700	..	.....
Battle cruisers[4]	.....	.....	..	.....	..	.....	..	.....
Armored cruisers	9	74,020	..	.....	2	13,380	..	.....
Cruisers[5]	7	20,030	3	6,223	5	13,815	2	6,966
Torpedo-boat destroyers	28	10,987	19	13,730	15	7,089	3	2,361
Torpedo-boats	68	11,584	2	240	36	6,048	27	6,642
Submarines	19	5,475	..	.....	6	1,686	8	4,400
Total tons built and total tons building	..	259,136	..	192,953	..	198,351	..	60,389
Total tons built and building		452,089				258,740		

[1] Battleships having a main battery of all big guns. (11 inches or more in caliber).
[2] Battleships of (about) 10,000 or more tons displacement, whose main batteries are of more than one caliber.
[3] Includes smaller battleships and monitors.
[4] Armored cruisers having guns of largest caliber in main battery and capable of taking their place in line of battle with the battleships. They have an increase of speed at the expense of carrying fewer guns in main battery and a decrease in armor protection.
[5] All unarmored warships of more than 1500 tons are classed as cruisers. Scouts are considered as cruisers in which battery and protection have been sacrificed to secure extreme speed. The word "protected" has been omitted because all cruisers except the smallest and oldest now have protective decks.
[6] Colonial vessels included.
[7] Includes 4 submarines authorized in 1913.

RELATIVE ORDER OF WARSHIP TONNAGE

Present Order (Tonnage Completed)	
Nation	Tonnage
Great Britain	2,052,711
Germany	943,338
United States	760,002
France	645,891
Japan	497,199
Russia	283,681
Italy	259,136
Austria	198,351

As Would Be the Case if vessels now Building were Completed	
Nation	Tonnage
Great Britain	2,591,291
Germany	1,228,208
United States	921,844
France	876,155
Japan	702,099
Russia	685,373
Italy	452,089
Austria	258,740

The following vessels are not included in the tables:

Ships over twenty years old from date of launch, unless they have been reconstructed and rearmed within five years.

Torpedo-craft over fifteen years old.

Those not actually begun or ordered, although authorized.

Transports, colliers, repair ships, torpedo depot ships, or other auxiliaries.

Vessels of less than 1500 tons, except torpedo craft.

Torpedo craft of less than 50 tons.

Vessels undergoing trials are considered as completed.

SEA STRENGTH

In order to answer the frequent inquiries of societies and persons throughout the country interested in the maintenance of the navy and its relative strength and importance in comparison with foreign navies, the following information has been compiled:

SHIPS

Table I.—Vessels Built

	Battleships, dreadnought type[1]	Battleships[2]	Battle cruisers[3]	Armored cruisers	Cruisers[4]	Destroyers	Torpedo-boats	Submarines	Coast defence vessels[5]
England	18	40	9	34	72[10]	143[10]	49	72	0
Germany	13	20	4	9	40	130	0	24	2
United States	7	24	0	11	14	46	18	25	4
France	2	18	0	20	10	81	139	75	1
Japan	2	13	1	13	14	54	28	13	2
Russia	0	8	0	6	9	93	14	30	2
Italy	2	8	0	9	7	28	68	19	0
Austria	2	6	0	2	5	15	36	6	6

Table II.—Vessels Building or Authorized

	Battleships, dreadnought type	Battle cruisers	Cruisers	Destroyers	Torpedo-boats	Submarines
England[6]	14	1[10]	20[10]	44[10]	0	22[10]
Germany[7]	6	3	4	12	0	12[9]
United States	5	0	0	16	0	26
France	9	0	0	5	0	18
Japan[8]	4	3	0	2	0	2
Russia[11]	7	4	8	45	0	25
Italy	7	0	3	19	2	0
Austria	2	0	2	3	27	8

[1] Battleships having a main battery of all big guns (11 inches or more in caliber).

[2] Battleships of (about) 10,000 tons or more displacement, and having more than one caliber in the main battery.

[3] Armored cruisers having guns of largest caliber in main battery and capable of taking their place in line of battle with the battleships. They have an increase of speed at the expense of carrying fewer guns in main battery, and a decrease in armor protection.

[4] Includes all unarmored cruising vessels above 1500 tons displacement.

[5] Includes smaller battleships and monitors. No more vessels of this class are being proposed or built by the great powers.

[6] England has no continuing shipbuilding policy, but usually lays down each year 4 or 5 armored ships with a proportional number of smaller vessels.

[7] Germany has a continuing shipbuilding program, governed by a fleet law authorized by the Reichstag. In 1913 there were authorized 2 battleships, 1 battle cruiser, 2 cruisers, 12 destroyers. Eventual strength to consist of 41 battleships, 20 armored cruisers, 40 cruisers, 144 destroyers, 72 submarines.

[8] $78,837,569 authorized to be expended from 1911 to 1917 for the construction of war vessels.

[9] $4,760,000 authorized for experiments and further construction.

[10] Includes vessels of colonies.

[11] Russian shipbuilding program provides for the completion by 1918 of 4 battle cruisers, 8 small cruisers, 36 destroyers, and 18 submarines.

The following vessels are *not* included in the tables:

Ships over twenty years old from date of launch, unless they have been reconstructed and rearmed within five years.

Torpedo craft over fifteen years old.

Transports, colliers, repair ships, converted merchant vessels, or any other auxiliaries.

Vessels of less than 1500 tons, except torpedo craft. Torpedo craft of less than 50 tons.

Vessels undergoing trials are considered as completed.

Table II includes vessels authorized but not yet laid down, as well as those actually under construction.

PERSONNEL

Rank	England	Germany	United States	France	Japan	Russia	Italy	Austria
Admirals of the Fleet	3	2	1[1]	.....	3	.....	.....	.....
Admirals	12	5	.....	.....	8	8	1	1
Vice Admirals	22	11	.....	15	18	18	18	3
Rear Admirals	56	22	25[7]	30	38	28	14	10
Captains and Commanders	683	356	207	360	259	160	131	67
Other line officers	2,414	1,881	1,549	1,457	1,915	1,321	1,011	614
Midshipmen at sea	563	398	0	60	145	157	.....	180
Engineer officers	848	573	.....	505	771	508	320	156
Medical officers	593	322	314	394[3]	373[6]	287	257[3]	91
Pay officers	685	267	231	219	362	.....	239	198
Naval Constructors	118	159	75	175	143[11]	535	110	14[8]
Chaplains	151	28	24	.....	.....	85	.....	12
Warrant officers	2,693	2,686	867	139[4]	1,553	.....	1,136	388
Enlisted men	115,208	60,920	49,854	60,505	43,847	47,318	33,864	18,712[10]
Marine officers	471	169[5]	345	.....	.....	.....	.....	.....
Enlisted men (Marines)	21,033[2]	5,597[5]	9,921	.....	.....	.....	.....	.....
Total	145,553	73,396	63,413	63,859	49,435	50,425	37,101	20,574

[1] The Admiral of the Navy.
[2] Includes 3130 men of the Coast Guard.
[3] Includes pharmacists.
[4] Includes adjudants principaux; does not include premier maitres and maitres.
[5] Marine infantry and seaman artillery.
[6] Includes pharmaceutical officers.
[7] The United States now has, temporarily, as extra numbers, due to promotion for war service, and to officers restricted by law to engineering duty on shore only, 6 flag officers, 20 captains, 9 commanders, 6 lieutenant commanders, and 1 lieutenant.
[8] Includes 15 officers of the Judge Advocates Corps.
[9] Includes 7 hydrographic engineers.
[10] Includes 4,000 recruits for 42 days.
[11] Includes 53 ordnance and 10 hydrographic engineers.

ARGENTINE REPUBLIC

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Rivadavia	28,000	22.5	12 12-in., 12 6-in.	Fore River Co.	Under trials
Moreno	28,000	22.5	same	New York Co.	Launched Sept. 28, 1911

NEW DESTROYERS.—The Krupp works are busy this year with four destroyers for Argentine. These boats are of 1250 tons, the dimensions being 312 feet long, 31 feet beam, and 8 feet 10 inches normal draft. The full load displacement is 1460 tons, which includes 345 tons of oil fuel. The speed is 32 knots; oil fuel has been adopted and the power, which exceeds 30,000 if the speed be obtained, is developed on three double-ended boilers. The armament comprises three 4-inch Bethlehem guns and four 21-inch torpedo tubes. The total cost of this flotilla is £521,726, of which £121,000 per boat is for hull, machinery, and equipment. The armament contracts are separate, being about £21,000 for the guns and ammunition ordered from the Bethlehem Company, and about £17,000 for the Whitehead—Fiume—torpedo equipment.—*The Engineer.*

DELAY THE "RIVADAVIA" TESTS.—An error in replacing the turbines on the Argentine battleship *Rivadavia* is expected to cause two weeks more of delay in her final speed tests off the coast. The *Rivadavia* was to have left her yard January 5 on a high course of tides, but after setting up the turbines, which had been taken apart for slight repairs, a slight fault in the working of the mechanism was discovered.—*New York Herald.*

"TENDERS."—The Argentine Government is again calling for tenders for the delivery of three motor ships and six motor tank ships for traffic on the Bermejo. The tank ships are wanted for bringing liquid fuel from new deposits in the interior to Buenos Ayres, and must be capable of using crude petroleum in their motors.—*Shipping,* Illustrated.

AUSTRIA

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Prinz Eugen..	20,010	20	12 12-in., 12 5.9-in., 6 t. t.	Trieste	Launched Nov. 30, 1912
Szent Istvan..	20,010	20	10 13.5-in., 12 5.9-in., 6 t. t.	Fiume	Laid down Jan. 29, 1912
Ersatz Mon'ch	25,000	25	10 14-in.	Trieste	To be laid down, spring 1914
" Budapest	25,000	25	same	"	" " " " " 1914
" Wien....	25,000	25	same	Fiume	" " " " " 1915
" Hapsburg	25,000	25	same	Trieste	" " " " " 1915

THE "SZENT ISTVAN."—Some delay appears to be taking place in the progress of the fourth battleship of the first dreadnought division, which is to be called the *Szent Istvan.* This is the only vessel of the four which is being built in Hungarian territory, as a concession to national sentiment. The Danubius yard at Fiume, where she is in hand, has previously built only small cruisers and torpedo craft. Her keel was laid on January 29, 1912, and at the end of 20 months the ship was still on the stocks, although the other three dreadnoughts took on the average only 13 months each to be put into the water. It is now reported that she will not be ready for trials until December, 1914, at the earliest, and will not be in commission until the following year. Until she is launched, the construction cannot be begun of the battleships of the second dreadnought division, which it is proposed to build at Fiume.—*Journal of the Royal United Service Institution.*

THE SECOND DREADNOUGHT DIVISION.—Further particulars have been published concerning the design of the battleships in this division. Their

The following vessels are *not* included in the tables:

Ships over twenty years old from date of launch, unless they have been reconstructed and rearmed within five years.

Torpedo craft over fifteen years old.

Transports, colliers, repair ships, converted merchant vessels, or any other auxiliaries.

Vessels of less than 1500 tons, except torpedo craft. Torpedo craft of less than 50 tons.

Vessels undergoing trials are considered as completed.

Table II includes vessels authorized but not yet laid down, as well as those actually under construction.

PERSONNEL

Rank	England	Germany	United States	France	Japan	Russia	Italy	Austria
Admirals of the Fleet.....	3	2	1[1]	.....	3	.....	.....	.....
Admirals.....	12	5	.....	.....	8	8	1	1
Vice Admirals	22	11	.....	15	18	18	18	3
Rear Admirals	56	22	25[7]	30	38	28	14	10
Captains and Commanders	683	356	207	360	259	160	131	67
Other line officers.....	2,414	1,881	1,549	1,457	1,915	1,321	1,011	614
Midshipmen at sea.....	563	398	0	60	145	157	.....	189
Engineer officers.....	848	573	.....	505	771	508	320	156
Medical officers.....	593	322	314	394[2]	373[6]	287	257[2]	91
Pay officers.....	685	267	231	219	362	.....	239	199[3]
Naval Constructors.....	118	159	75	175	143[11]	535	110	14[9]
Chaplains	151	28	24	.....	.....	85	.....	11
Warrant officers	2,693	2,686	867	139[4]	1,553	.....	1,136	388
Enlisted men.....	115,208	60,920	49,854	60,505	43,847	47,318	33,864	18,712[10]
Marine officers.....	471	169[5]	345	.....	.....	.....	.....	.....
Enlisted men (Marines)..	21,033[8]	5,597[5]	9,921	.....	.....	.....	.....	.....
Total	145,553	73,396	63,413	63,859	49,435	50,425	37,101	20,574

[1] The Admiral of the Navy.
[2] Includes 3130 men of the Coast Guard.
[3] Includes pharmacists.
[4] Includes adjudants principaux; does not include premier maitres and maitres.
[5] Marine infantry and seaman artillery.
[6] Includes pharmaceutical officers.
[7] The United States now has, temporarily, as extra numbers, due to promotion for war service, and to officers restricted by law to engineering duty on shore only, 6 flag officers, 20 captains, 9 commanders, 6 lieutenant commanders, and 1 lieutenant.
[8] Includes 15 officers of the Judge Advocates Corps.
[9] Includes 7 hydrographic engineers.
[10] Includes 4,000 recruits for 42 days.
[11] Includes 53 ordnance and 10 hydrographic engineers.

ARGENTINE REPUBLIC

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Rivadavia.....	28,000	22.5	12 12-in., 12 6-in.	Fore River Co.	Under trials
Moreno.....	28,000	22.5	same	New York Co.	Launched Sept. 28, 1911

NEW DESTROYERS.—The Krupp works are busy this year with four destroyers for Argentine. These boats are of 1250 tons, the dimensions being 312 feet long, 31 feet beam, and 8 feet 10 inches normal draft. The full load displacement is 1460 tons, which includes 345 tons of oil fuel. The speed is 32 knots; oil fuel has been adopted and the power, which exceeds 30,000 if the speed be obtained, is developed on three double-ended boilers. The armament comprises three 4-inch Bethlehem guns and four 21-inch torpedo tubes. The total cost of this flotilla is £521,726, of which £121,000 per boat is for hull, machinery, and equipment. The armament contracts are separate, being about £21,000 for the guns and ammunition ordered from the Bethlehem Company, and about £17,000 for the Whitehead—Fiume—torpedo equipment.—*The Engineer.*

DELAY THE "RIVADAVIA" TESTS.—An error in replacing the turbines on the Argentine battleship *Rivadavia* is expected to cause two weeks more of delay in her final speed tests off the coast. The *Rivadavia* was to have left her yard January 5 on a high course of tides, but after setting up the turbines, which had been taken apart for slight repairs, a slight fault in the working of the mechanism was discovered.—*New York Herald.*

"TENDERS."—The Argentine Government is again calling for tenders for the delivery of three motor ships and six motor tank ships for traffic on the Bermejo. The tank ships are wanted for bringing liquid fuel from new deposits in the interior to Buenos Ayres, and must be capable of using crude petroleum in their motors.—*Shipping,* Illustrated.

AUSTRIA

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Prinz Eugen..	20,010	20	12 12-in., 12 5.9-in., 6 t. t.	Trieste	Launched Nov. 30, 1912
Szent Istvan..	20,010	20	10 13.5-in., 12 5.9-in., 6 t. t.	Fiume	Laid down Jan. 29, 1912
Ersatz Mon'ch	25,000	25	10 14-in.	Trieste	To be laid down, spring 1914
" Budapest	25,000	25	same	"	" " " " " 1914
" Wien....	25,000	25	same	Fiume	" " " " " 1915
" Hapsburg	25,000	25	same	Trieste	" " " " " 1915

THE "SZENT ISTVAN."—Some delay appears to be taking place in the progress of the fourth battleship of the first dreadnought division, which is to be called the *Szent Istvan.* This is the only vessel of the four which is being built in Hungarian territory, as a concession to national sentiment. The Danubius yard at Fiume, where she is in hand, has previously built only small cruisers and torpedo craft. Her keel was laid on January 29, 1912, and at the end of 20 months the ship was still on the stocks, although the other three dreadnoughts took on the average only 13 months each to be put into the water. It is now reported that she will not be ready for trials until December, 1914, at the earliest, and will not be in commission until the following year. Until she is launched, the construction cannot be begun of the battleships of the second dreadnought division, which it is proposed to build at Fiume.—*Journal of the Royal United Service Institution.*

THE SECOND DREADNOUGHT DIVISION.—Further particulars have been published concerning the design of the battleships in this division. Their

main armament will consist of ten 14-inch guns, 45 calibers in length, weighing about 70 tons, supplied by the Skodawerke at Pilsen. The triple-turret system of the *Viribus Unitis* class has been abandoned in favor of a return to twin turrets, of which there will be five mounted on the middle line of the ship. Anti-air craft guns will be carried and the vessel will be provided with strong screens for protection against aerial attack.—*Journal of the Royal United Service Institution.*

DESTROYERS.—The six destroyers *Balatan, Esepel, Leka, Orfev, Triglav* and *Fatia* are nearly finished, the last three having been launched in December, 1913, in an advanced state and the other three undergoing trials. These boats have 800 tons displacement, 32 knots speed, an armament of two 4-inch, six 37-mm. and two torpedo tubes.—*Moniteur de la Flotte.*

"BALATON."—The destroyer *Balaton,* built in Fiume, attained a speed of 33 knots on her trials, having been designed for 32.5 knots. The *Balaton* is the second of the 800-ton destroyers built in Austria and has oil fuel and 17,000 horse-power steam turbines.—*Marine Rundschau.*

TORPEDO-BOATS.—Orders have been given for the construction of 16 seagoing torpedo-boats. The new boats will be built at Fiume, and, like their predecessors, are for the replacement of obsolete craft. They are of 250 tons displacement, have engines of 5000 horse-power to give them a speed of 29 knots, and carry two torpedo tubes and three 70-mm. quick firing guns.—*Journal of the Royal United Service Institution.*

SUBMARINES.—The five new submarines, Nos. 11-15, will have a displacement of about 600 to 700 tons and are notably superior to their predecessors, since they have greater speed and radius of action both on the surface and submerged. Austria already possesses six of 240 tons, and three under construction of 550 tons.—*Moniteur de la Flotte.*

PERSONNEL.—The Austro-Hungarian Navy estimates make provision for a notable increase in the personnel. At the present date the yearly contingent of recruits is 6000 and the total strength of the non-commissioned establishment 20,000. The contemplated increase will add 2000 men to each annual contingent, and as in the Austro-Hungarian fleet the period of service is four years, by 1917 the personnel will have grown to 28,000. It is understood, however, that the parliamentary representatives have made their acceptance of the new program conditional on the reduction of compulsory naval service from four to three years. As by far the major proportion of naval recruits come from the coastal provinces and have had a good deal of previous experience in the ways of the sea, it is believed that three years will be ample to train them up to the requisite standard of efficiency. The marine ministry is opposed to the reduction, but it will probably have to give way. Should the personnel increases be sanctioned, they will involve the maintenance in commission of more seagoing ships and for a greater part of the year than is considered necessary at present. A training squadron, comprising the three small battleships of the *Habsburg* class and a protected cruiser, will be kept in commission throughout the winter and will absorb about one-half of the new recruits every year. The squadron will, in effect, fulfill the same functions as the new third squadron of the German high-sea fleet.—*Naval and Military Record.*

NAVAL PROGRAM.—Credits necessary for laying down two of the new battleships, the *Ersatz Wien* and *Ersatz Budapest* were asked for at the meeting in October of the joint council of Austrian and Hungarian Ministers. Each of these is to cost about $15,000,000.00. The same sum of money will be asked for at the end of 1914 for the other two vessels of this class, the *Ersatz Monarch* and *Ersatz Hapsburg.* At this latter date

$30,000,000.00 more will be required for four new scout cruisers, destroyers and submarines. There is some doubt as to whether these sums will be obtained on account of the heavy expenses incurred in the 1913 program.—*Le Yacht.*

NAVAL BASE AT SEBENICO.—It was again reported in November that the Austrian Navy Department is to establish a naval base at Sebenico, on the Dalmatian coast, about 70 miles southeast of Trieste. The town, of 29,000 inhabitants, is a favorite resort of tourists. It was visited nearly four years ago by Admiral Count Montecuculi, then Marine Commandant and Chief of the Navy Department, accompanied by his staff, and sites for fortification were said to have been approved. It is understood that a wireless station was erected there some time ago.—*Journal of the Royal United Service Institution.*

TURRET TRIALS OF THE "TEGETTHOFF."—We have information that, while the *Tegetthoff* was engaged in turret trials last July, a discharge from one of her 12-inch guns fired horizontally in line with the keel twisted the after shore beams of the bridge and wrecked the officers' state rooms situated below.—*Le Yacht.*

NEW CRUISERS.—The first of the new class of cruisers will be laid down in 1914. These cruisers will be of much greater displacement (4800 tons) than their predecessors of the *Admiral Spaun* class (3500 tons). The increased displacement will be used partly for more powerful machinery and increased speed, and partly for more powerful armament and increased steaming radius; the designed speed is 29 knots (an increase of 1½ knots). These new cruisers will have either an homogeneous armament of 12-cm. guns like the *Zenta* class, or, in addition to a broadside battery of 10-cm. guns, a 15-cm. gun forward and aft. The construction period is about two years and the cost of each ship about 10½ millions of marks. Three of these cruisers are to be built in the next four years, and this will complete the program of 12 small, fast cruisers.—*Marine Rundschau.*

COLOR OF WARSHIPS.—The brownish-green color of Austrian war vessels is to be changed to a gray similar to that used in the German Navy.—*Marine Rundschau.*

THE FLEET ON A WAR FOOTING.—Replying in a recent speech before the Hungarian Naval Committee to certain criticisms respecting the cost of the naval mobilization during the Balkan crisis, Admiral Haus denied that the Austro-Hungarian fleet had been mobilized. It had, he said, merely been "placed in service." This was obviously an official euphemism, for it is not denied that for the first four months of 1913 practically every efficient unit of the fleet was fully manned, provisioned, and coaled in instant readiness for action. The very fact that 10,000 reservists were called upon for duty is proof that a full-dress mobilization was in progress. Admiral Haus is, no doubt, perfectly right in his objection to the use of the word "mobilization" as a synonym for preparation for war against any particular power. What did happen was that the fleet was made immediately ready to meet any emergency, and the capable manner in which the operation was conducted not only reflected credit on the naval administration, but furnished an object-lesson of the high state of efficiency to which the fleet has been brought. By March, 1913, there were assembled at Pola the following ships, each fully manned and equipped and ready to put to sea at the word of command: thirteen battleships, three armored cruisers, five protected cruisers, twelve destroyers, and twenty-four seagoing torpedo-boats. This fleet was inspected by Admiral Montecuccoli, the then Marine Commandant, who pronounced it to be in a thoroughly efficient condition, and Admiral Haus has since testified in terms of high praise to the smartness and

capability of the personnel, regulars and reservists alike. It may safely be said that few of the naval powers could have put the whole of their available material on a war footing with such thoroughness and promptitude, and above all with so little fuss, as Austria-Hungary contrived to do in the early part of last year.

An official announcement by the Marine Section (the Austrian equivalent for Admiralty) gives the following information: the 1100-ton mine ship building at Pola has been named *Chamäleon*, and the two new fleet colliers have been given the names of *Pola* and *Teodo* respectively. It has been decided to substitute numerals for names in the case of the twenty-seven torpedo-boats of 250 tons now building, and each boat will have the initial letter of the building yard affixed to its number. Thus the eight Trieste boats will be designed *74 T* to *81 T*, the sixteen Fiume boats *82 F* to *97 F*, and the three Monfalcone ones *98 M* to *100 M*. This system has been adopted from Germany, and it has the advantage that if any boat behaves particularly well or particularly badly in service, the public at once know which builder should have the credit or blame, as the case may be.—*Naval and Military Record.*

BELGIUM

NAVAL PROGRAM.—Belgium's new naval program includes the laying down of two cruiser battleships and four river monitors; two of the latter for her own coasts, and the other two for the protection of her colony on the Congo. About $40,000,000.00 is to be spent. This sum is expected to pay for the construction of the ships mentioned above, the establishment of naval bases, the armament and equipment of the personnel, and the original outfitting.—*Le Yacht.*

BRAZIL

NEW DREADNOUGHT.—It is officially announced that the Brazilian Government laid a scheme before Messrs. Armstrong, the builders of the *Rio Janeiro*, the Brazilian battleship which has been sold to Turkey, proposing that the firm shall construct another dreadnought without any loss to the Brazilian treasury, Messrs. Armstrong being given full permission to dispose of the *Rio Janeiro* without any intervention on the part of the Brazilian Government. The proposal having been accepted, the new warship will be constructed on conditions laid down by the Minister of Marine, Messrs. Armstrong having already negotiated the sale of the *Rio Janeiro*, which has been returned to them.—*Naval and Military Record.*

BRITISH TYPE FOR BRAZILIAN WARSHIP.—The dreadnought to be contracted for in substitution for the *Rio de Janeiro*, recently sold to Turkey, will be of the type of the *Queen Elizabeth*, the new British battleship, with a displacement of 27,500 tons, a speed of 25 knots and eight or ten 15-inch guns.

BRAZILIAN RIVER MONITORS.—The river monitors built by Messrs. Vickers, Ltd., for the Brazilian Government are making rapid progress. The first of the three, the *Javary*, has gone through her trials very satisfactorily, after alterations in her design and construction suggested as a result of her trials on the Clyde. Her sister ships, the *Solomies* and the *Madeira*, were ready to go for their trials on the Clyde, the first-named in the middle of December, and the last-named in the middle of January.—*The Marine Engineering and Naval Architect.*

BULGARIA

Increased naval activity, consequent to the lessons of the Balkan War, may be noted in all the Balkan States. Bulgaria, with an outlet into the Aegean, has undertaken a definite naval program, restricted, however, by

the financial burden of the government. A harbor is to be constructed at Portolagos, and plans are under way for four destroyers of about 400 tons, 12 torpedo-boats of about 200 tons, one tender, and one monitor.—*Marine Rundschau.*

CHILE

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Almirante Latorre	27,500	23	10 14-in., 22 5-in.	Vickers	Launched Nov. 27, 1913
Almirante Cochrane	27,500	23	same	Elswick	Laid down April, 1913

"ALMIRANTE LATORRE."—The *Almirante Latorre* was launched at the yard of Messrs. Armstrong Whitworth & Co., on the Tyne, November 27, 1913. She is reported due for completion by December, 1914.

DESTROYERS.—The two destroyers, the *Almirante Lynch* and *Almirante Condell,* built for the Chilean Government by Messrs. J. Samuel White & Co., of Cowes, are now ready for immediate delivery to the Chilean Navy. They are 320 feet in length, and have gone through satisfactory trials.—*Page's Engineering Weekly.*

CHINA

NAVAL COLLEGE.—The Chinese Government has decided to establish a naval college at Nimrod Sound, Shanghai, and to increase the number of training ships. Application was therefore made to the British Government for the loan of officers for instructional purposes, and the application being approved, the services of Commander Harold Christian have been acquired for a period of three years as director of the new college.—*Journal of the Royal United Service Institution.*

DENMARK

NEW BATTLESHIP.—A new coast defence battleship for the Danish Navy has recently been laid down at Copenhagen. This vessel, at present unnamed, was authorized in 1911, and although slightly larger and improved in certain particulars, she will be similar in general character to the five small battleships already in the fleet. Her displacement will be 3675 tons; engines of 5400 horse-power will give her a speed of 16 knots; the armament will include two 9.4-inch and four 5.9-inch guns; and there will be an armored belt of from four to seven inches in thickness. The vessel will also have four submerged torpedo tubes. It is five years since the last battleship was launched for the Danish fleet.—*Journal of the Royal United Service Institution.*

NEW TORPEDO-BOAT.—A new Danish torpedo-boat, *Svärdfisken,* similar to the *Delfriren* and *Hoalrossen,* was launched from the Royal Dockyard, Copenhagen, on October 25. This boat, like the other two, is of 168 tons displacement, and has an engine of 3400 horse-power, the estimated speed being 26 knots. One of the others made 26.3 knots on her trial trip. The armament consists of one 75 mm. cartridge gun and four torpedo-firing appliances.

FRANCE

VESSELS BUILDING

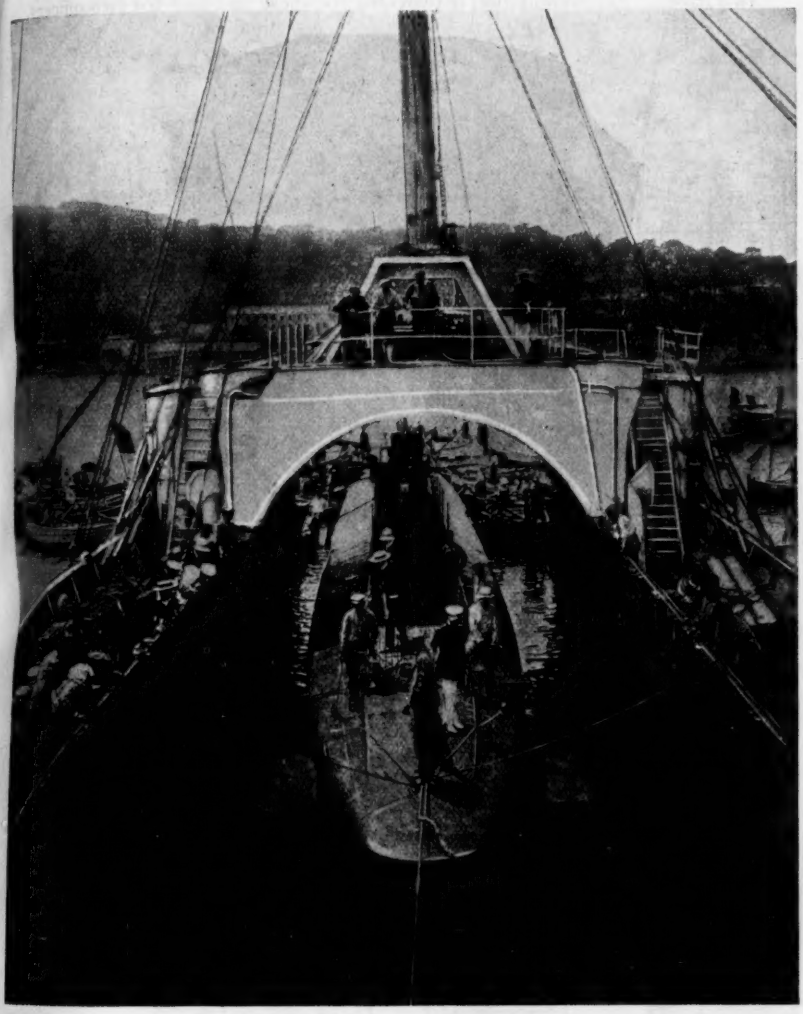
Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Courbet	23,500	21	12 12-in., 22 5.5-in.	Lorient	Commissioned Nov. 19, '13
Jean Bart	23,500	21	same	Brest	" Nov. 19, '13
France	23,500	21	same	St. Nazaire	Launched Nov. 7, 1912
Paris	23,500	21	same	La Seyne	" Sept. 28, 1912
Bretagne	23,600	20	10 13.5-in., 22 5.5-in.	Brest	" April 21, 1913
Provence	23,600	20	same	Lorient	" April 20, 1913
Lorraine	23,600	20	same	St. Nazaire	" Sept. 30, 1913
Languedoc	25,200	21	12 13.5-in., 24 5.5-in.	La Seyne	Laid down May 1, 1913
Normandie	25,200	21	same	St. Nazaire	" May 1, 1913
Flandre	25,200	21	same	Brest	" Oct. 10, 1913
Gascogne	25,200	21	same	Lorient	" Feb. 10, 1913
Vendée	25,200	21	same	La Seyne	To be laid down Jan., '14

NEW BATTLESHIPS.—One of the last acts of M. Baudin as French Minister of Marine, was to describe at a meeting of the Council of Ministers, the intended characteristics of the four battleships which, under the names of *Lyon, Lille, Duquesne* and *Tourville,* it is prepared to lay down in 1915. They would, he said, displace from 28,000 to 30,000 tons, and have a main armament of sixteen 13.38-inch guns in four turrets placed on the middle line, thus exceeding by one-third the armament, and doubtless to some extent, the length of the *Normandie* class, of which the fifth, the *Béarn,* will be laid down in January. The gun will be of a new model, firing a new type of shell with high velocity. A radical government having been formed, with M. Monis as Minister of Marine, that gentleman will have a formidable task to undertake, and will have leisure to ascertain that French designers, in adding to the number of big guns, were following a line of policy opposed to our own. The navy estimates of 1914 amount to £19,165,000, being an increase of £1,783,800, mainly for increased pay and numbers, and for ships in commission. The total sum to be expended next year for the execution of the naval program is £13,190,000, including £34,000 for aviation. These charges are only partially included in the ordinary estimates. The total intended outlay is £25,347,300.—*Army and Navy Gazette.*

THE "KANGAROO."—*Transport Ship for Submarines.*—A French firm of naval architects, who have frequent occasion to deliver submersible boats to foreign navies, have found it convenient to provide themselves with a specially constructed transport boat, of which we publish illustrations herewith. The shipping and unshipping of the submarines is carried out by the transport ship itself without any outside assistance, and in perfect safety. As will be seen from our illustrations the hull of the ship is pierced by a broad central tunnel, into which the submarine can be drawn. The draft of the vessel can be varied at will by shipping or unshipping water ballast. The principal dimensions of the *Kangaroo* are as follows: Length between perpendiculars, 305 feet; extreme breadth, 39 feet 4 inches; depth, 23 feet 10 inches; mean draft, loaded, 19 feet 7 inches; displacement at the said draft, 5540 tons; dead-weight carrying capacity, 3830 tons; speed, 11 knots. The hold measures 59 meters (193 feet 6 inches) in length, 9 meters (29 feet 6 inches) in breadth, and the vertical sides have a height of 6.20 meters (20 feet 4 inches), giving a capacity of 3300 cubic meters (116,545 cubic feet). The boat is equipped with vertical triple-expansion engines

developing 850 horse-power. The bunker capacity is 540 tons of coal. The operation of shipping a submarine boat is as follows:

Water ballast is admitted in such manner as to cause the transport ship to dip down at the stern, and the door closing the tunnel is removed. The



"KANGAROO"

ship is then allowed to increase her draft forward, water enters the inner dock, and the submersible is allowed to float into the tunnel. When it reaches its position amidships it is placed over keel blocks and shored up. The transport is then raised by discharging water ballast, the door to the tunnel being closed, and the water is pumped out of the dock. The ship

is evened up, and is then ready to start on its journey. The cargo is discharged by reversing the operations described for the shipping.

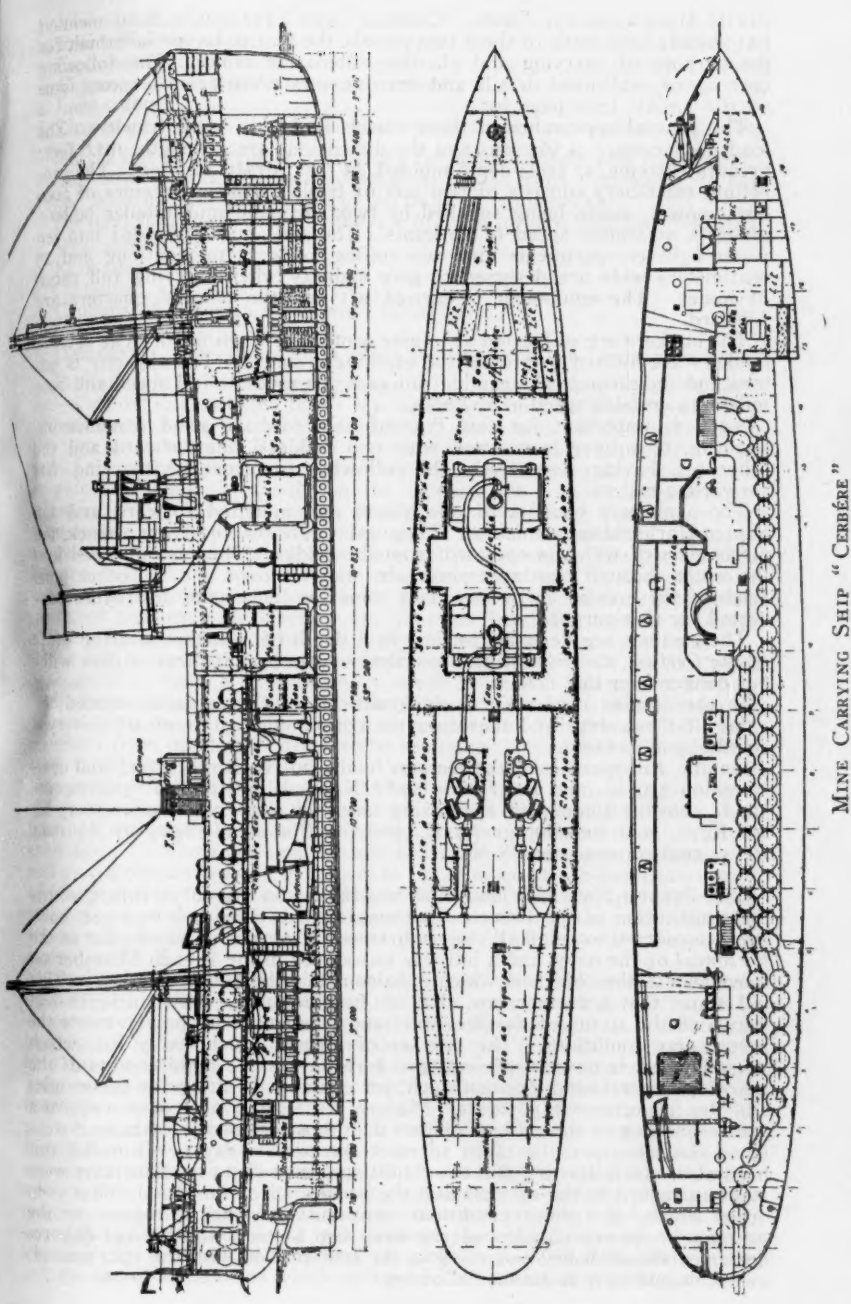
The crew consists of the captain, chief officer, three engineers, two petty officers, thirteen seamen, including stokers and two boys, a total of twenty-two hands. Accommodation is provided for these and also for two officers,

SUBMARINE BEING WARPED, STERN FIRST, THROUGH THE OPEN BOW OF THE "KANGAROO," INTO THE HOLE

THE "KANGAROO" WITH STERN OPEN TO RECEIVE A SUBMARINE

four petty officers, and sixteen men, forming the officers and crew of a submersible boat.

The *Kangaroo* has been designed primarily for the transport of submarines as stated. But it can do duty also for carrying heavy and bulky loads, such as turbines, locomotives, etc., which can be lowered into the hold amidships. The *Kangaroo* has now been in service for some time and has proved itself well adapted to its task.—*Scientific American Supplement.*



MINE CARRYING SHIP "CERBÈRE"

THE MINE CARRYING SHIPS, "CERBÉRE" AND "PLUTON."—Brief mention has already been made of these two vessels, the first to be specially built for the purpose of carrying and planting submarine mines. The following corrections, additional details and drawings are taken from a recent issue of *Le Yacht*. (See page 197.)

The general appearance of these vessels is that of large trawlers. The load displacement is 594 tons and the dimensions are: Length, 193.6 feet; breadth extreme, 27 feet; depth molded, 13 feet; draft, 10.2 feet. The propelling machinery consists of two sets of triple expansion engines of 6000 horse-power, steam being supplied by two Normand multitubular boilers, giving a maximum speed of 20 knots. The steel hull is divided into ten water-tight compartments and two rolling keels 25 meters long and 25 centimeters wide are designed to give stability when carrying full cargo of mines. The equipment is carried aft and the officers' quarters are forward.

The bunkers are so located as to give protection when filled. The reserve bunkers are located to protect the machinery spaces. The capacity is 900 tons and the theoretical steaming radius is 300 miles at full speed and 1900 miles at a cruising speed of 16 knots.

As it is important for this type of ship to have good maneuvering qualities, they have been fitted with two rudders, one forward and the other aft, having respectively the following surfaces: Aft, 4 mq. 60; forward, 2 mq. 20.

The armament consists of one 3-inch gun mounted forward and 140 Sauter Harlé submarine mines. These mines are planted from a track, the mechanism of which is operated from the bridge. They are dropped into the water through two large ports aft, one starboard and the other port. Each of these ships carries as many mines as ten of the destroyers converted for this purpose.

These mines are designed to float at a depth of 4 meters and the draft of the *Cerbére* and *Pluton* has been designed to permit them to pass without danger over this field.

In the opinion of *Le Yacht* the practical tests have demonstrated the value of these ships and therefore the construction of more of this type should be authorized.

On the full-speed trial the *Cerbére* made 20 N., Revs. 278.1, coal consumption 350 K., and the *Pluton* 20.87 N., Revs. 272.4, coal consumption 377 K. On the 8-hour trial at cruising speed the *Cerbére* averaged 16.45 N., 202 Revs., coal consumption 87 K., and the *Pluton* averaged 16 N., 192.5 Revs., coal consumption 78 K.

THE FRENCH NAVY.—A law which was passed on March 30, 1912, governs the constitution of the French maritime defence. This law was not, however, considered to fulfill all the requirements from the point of view of the *personnel* of the navy, and a bill was introduced in the French Chamber on November 4, the object of which is to complete the law in question. This bill states that a former law, that of June 10, 1896, which hitherto had regulated the status of the *personnel* and promotion, no longer meets the present-day conditions. The number of officers on the navy list, which it established, is now insufficient to ensure the service requirements of the new departments since formed, such, for example, as those for aeronautics and the inspection of powders. Modern battleships, moreover, require a greater number of subordinate officers than those of former years, and steps have of necessity to be taken to meet the present-day needs under this head also. In order to fulfill the conditions, even if no modifications were made in regard to the services and the promotion of the naval officers—in other words, if former conditions continued to rule in regard to the *personnel*—the composition of the navy list to meet the present-day requirements, established according to the law of 1896 with the 1912 amendments, would have to be the following:

a. Vice admirals	16
b. Rear admirals	30
c. Captains	115
d. Captains of less than three years seniority	250
e. Lieutenants	1100
f. Lieutenants of less than eight years seniority and sub-lieutenants	870

But the bill of November 4 provides for modifications, and recommends, among other points, the re-establishment of the rank "capitaine de corvette," which would correspond to our rank of commander.

The navy list, as governed by the law of June 10, 1896, was the following:

a. Vice admirals	15
b. Rear admirals	30
c. Captains	125
d. Captains of less than three years seniority	215
e. Lieutenants	754
f. Lieutenants of less than eight years seniority and sub-lieutenants	590

At first sight it would appear, says the bill in question, that this latter list—*i. e.*, the one included in the law of 1896—would be more favorable to promotion than the one which precedes it above and which resulted from the 1912 amendments. But such is not the case in reality, since the average age of the officers promoted to the rank of captains under d, "capitaines de frégate," has been gradually on the increase; it is now forty-five, and statistics show that this average would very soon reach forty-seven, and even exceed this latter average. The age of the senior captains, "capitaines de vaisseau," and admirals follows in equal progression. The French naval officers, it is stated, are generally ten years older than foreign officers of equal rank, and many of them, seeing no chance of promotion, become discouraged and leave the service. On the other hand, the number of cadets entering the naval college has gradually decreased for some years past.

The bill in question proposes to improve the situation. In the first place, it proposes to make a large call upon the fleet crews. The ancient corps of "adjudants principaux"—*i. e.*, the highest ranking non-commissioned officers—is to be transformed into a larger corps of "fleet crews' officers"; members from this latter corps, whilst retaining their special calling, will be taken for duty in the land and school services as occasion requires, and will thus occupy positions which hitherto had to be taken by a large number of the junior lieutenants and by most of the sub-lieutenants. These steps, together with the placing on board of chief petty officers—*i. e.*, "maitres principaux" (who rank immediately below the "adjudants principaux"), will give a certain latitude in respect to the number of sub-lieutenants, most of whom are in future to be employed on board ship, and are expected to remove one of the difficulties the navy has met with in the past. But they would not reduce the average age of the officers promoted to the rank of captain under d.

Considering the situation from this point of view, the promoters of the bill find it absolutely necessary to establish anew the rank of "capitaine de corvette" (equal to that of major in the French Army), which would correspond to our rank of commander, and also to provide a position on land for those officers who would be detached from service with the main fleets when occupying that rank. Such a position on land would now be available owing to the necessary transformation of the corps of hydrographers, and to the institution of a corps for the defence of the naval fortifications. The re-establishment of the rank of commander has been repeatedly urged from the military standpoint. Its re-establishment, moreover, is fully justified by the following consideration—namely, that in order to compensate for the risks of a career in which success will become more uncertain as time goes on, it is incumbent upon the Admiralty to offer to the staff the prospect of obtaining as early as possible both the material and the moral advantages which surround the position of a senior officer.

The extension of the French colonial possessions, the increase in the displacement and in the speed of ships, the development of submarine navigation, demand the complete reorganizing of the hydrography department. Notwithstanding their zeal and capability, the eighteen officers now constituting the staff of this department are able only to undertake a minute portion of the work required. By increasing this staff to forty-five officers, as the bill proposes, there will be a possibility of promotion in the corps, and if its members be selected from among the navigating officers they will be able to command their own special ships, and thus to centralize all the questions which appertain to their department. The corps for the defence of the naval fortified towns is, according to the bill, to be in future under the jurisdiction of the naval authorities, and its members will be selected from amongst naval officers.

The bill then proposes the following for the composition of the navy list:

a. Vice admirals	16
b. Rear admirals	30
c. Captains (capitaines de vaisseau)	115
d. Captains of less than three years seniority (capitaines de frégate)	210
d¹. Commanders (capitaines de corvette)	325
e. Lieutenants	830
f. Lieutenants of less than eight years seniority f¹. Sub-lieutenants	Number to vary, but to be a total of about 740.

The officers, from the rank of captain downwards, would be placed on the retired list at the following age limits:

	Fleet Service. Years.	Hydrography and Defence Dep'ts. Years.
Captains (capitaines de vaisseau)	55	60
Captains (capitaines de frégate)	53	58
Commanders	50	56
Lieutenants	50	53
Sub-lieutenants	48	—

The higher non-commissioned officers in the fleet service would retire at 56, 53 and 50 years of age, according to their rank.

The bill also enters into the details of the service, and gives the conditions which rule for promotion and pensions. We find in it no reference to the naval engineer-officers, which confirms us in the belief that in France this point has been settled by former legislation to the satisfaction of all concerned.—*Engineering.*

THE CONSEIL D'AMIRAUTÉ.—As an improvement upon the Conseil Supérieur, which was only an advisory committee, M. Baudin, the Minister of Marine, has created a "Conseil d'Amirauté," which has executive authority. This "Conseil d'Amirauté" consists of four officers who direct the activities of all the bureaus of the Ministry. Admiral Lebris, chief of the naval staff, has duties comparable to those of the First Sea Lord; Admiral Gaschard controls personnel matters; Admiral Pivet is manager of all construction work and Admiral Darrieus is chief of the office of the Minister of Marine, and the Minister himself presides at the weekly meeting of the committee.

NEW NAVAL ARSENAL.—Upon the return of the Minister of Marine from his tour of inspection to Bizerta, Tunis and Algiers, it was announced that he intended to give particular attention to the north coast of Africa, on account of the increasing interests of France in the Mediterranean. Bizerta, on the Tunisian coast, is to be made a naval arsenal of the first class, as by

its position it commands the through route between Gibraltar and the Suez Canal. The work will be begun by the rebuilding and re-arming of the coast defences; then the magazines and storehouses will be moved nearer to the docks in order that the ships may be supplied more rapidly with ammunition, fuel and provisions. Also there will be created a naval arrondissement for the north coast of Africa, with the headquarters of its chief at Bizerta.—*Marine Rundschau.*

NEW ORGANIZATION OF FRENCH FLEET.—The *Moniteur de la Flotte,* in commenting on the new organization of the French fleet, argues against the combination of eight ships in a squadron and in favor of six ships, summing up as follows:

In the year 1914, 22 large units (4 *Barts,* 6 *Dantons,* 6 *Patrie-Suffrens,* 6 *Gaulois-Bouvets*) will be in active service in the fleet.

It is madness for France unnecessarily to weaken her position in the Mediterranean by leaving out of action her 12,000-ton battleships, which, though old, are fit for battle and have heavy armor and heavy armament.

No gain in homogeneousness and speed can compensate for the loss in gun power. The disbanding of the third squadron will deprive the fleet commander of 24 heavy guns; and it is only by overwhelming superiority of fire that battles can be won.

Four-unit divisions and eight-unit squadrons doubtless have their advantages as battle organizations, but the French six-unit organizations were handier and their tactical worth carefully studied. In the hands of a French admiral they were proved weapons. It is wrong to simply throw away so much experience, to begin all over again with new organizations, and to keep on experimenting.

The more ships there are for maneuvering the greater will be the benefits derived, because advantages for training are supplied both by enlarging the field of tactical problems and by permitting a larger number of officers to gain experience. From the 22 ships in four squadrons important elements of improvement could be developed; for example, admirals could get tactical training which would be impossible in a smaller fleet such as that of 16 units proposed by Admiral de Lapeyrère.

SHIPBUILDING WORK.—The distribution of shipbuilding work to the several arsenals is to be as follows:

Lorient and Brest, armored ships, some of which will also be built in private yards. The new 6000-ton cruisers, whose plans are now being made up, will be built in private yards.

Toulon and Cherbourg, submarines only, as in both these ports experiments can most easily be carried out.

Rochefort, destroyers of 800-1000 tons; tugs and lighters.

Before a decision is reached on the propelling machinery to be placed in the submarines of the French 1914 program, there will be carried out in the Mediterranean Sea a series of experiments for the comparison of boats equipped with steam and with Diesel engines. The internal combustion engines, which have been considered unreliable on account of numerous break downs, should make a good showing with improved installation and more careful handling. The submarine *Coulomb* is to make an endurance run of 900 sea miles at speed of 10-11 knots; there will also be extended maneuvers off Corsica, in which submarines propelled by steam and Diesel engines will take part.

The submarine *Coulomb* had to give up her 900-mile endurance run and return to Toulon on account of the breaking of a fastening bolt of the port shaft-bearing.

There have recently been no less than eight anchor chains carried away: *Justice, République* and *Vérité* one each; *Jules Ferry* three, and *Démocratie*

two; it seems that the anchors of the *Démocratie* class are too large or their chains are too light.—*Mitt. aus dem Geb. des Seew.*

REDUCED COMPLEMENTS OF OFFICERS.—The deficiency of older officers is at present very noticeable. Since the measures for the creation of a sufficiently large supply for the increased needs of the fleet will not be in operation until next year, and will then only supply a gradual increase, the Ministry of Marine has found it obligatory to reduce the complement of officers for manning individual ships and shore establishments. The complement of officers for the several types of ships is to be as follows:

Type of Ship	Capitaine de vaisseau	Capitaine de frégate	Lieut. de vaisseau ancien	Lieut. de vaisseau	Enseigne de vaisseau 1e classe	Enseigne de vaisseau 2e classe	Total
Battleships (over 20,000 tons)	1	2	.....	6[1]	4[2]	3	16
Do. (Danton class)	1	2	.....	5[1]	4[2]	3	15
Do. (Patrié class)	1	2	.....	5[1]	4[2]	2	14
Do. (Saint-Louis class)	1	1	1	5[1]	4[2]	2	14
Cruisers (Quinet-Gambetta class)	1	2	.....	5[1]	4[2]	2	14
Do. (Condé-Montcalm class)	1	1	1	4[1]	2[2]	2	11
Do. (Kléber class)	.....	1	1	1	4[2]	4	11
Do. (Bruix class)	.....	1	1	.....	4[2]	2	8
Do. (Du Chayla class)	.....	1	1	.....	4[2]	2	8
Do. (Cosmao class)	.....	1	1	.....	3	2	7
Do. (Kersaint-D'Iberville class)	.....	1	1	.....	3	1	6
Destroyers (over 500 tons)	.....	.....	.....	1	1	1	3
Do. (under 500 tons)	.....	.....	.....	1	1	.....	2
Submarines (over 500 tons)	.....	.....	.....	1	2	.....	3
Do. (under 500 tons)	.....	.....	.....	1	1	.....	2
Gunboats (Décidée class)	.....	.....	.....	1	3	2	6
Do. (Argus class)	.....	.....	.....	1	1	.....	2
Coast survey ships	.....	1	1	.....	4	4	10

[1] Including 2 gunnery and 1 torpedo officer.

[2] Including 3 gunnery and 1 torpedo officer.

[3] Including 1 gunnery and 1 torpedo officer.

—*Mitt. aus dem Geb. des Seew.*

PERSONNEL.—The Ministry of Marine has prepared a bill dealing with the adjustment of the complement of men necessary to man the ships of the fleet. In 1912 11,000 men were mustered into service; in 1913 16,000 men were needed; and it is estimated that the placing of new ships in commission in 1914 will require 20,000 men for the annual conscription. As the present number of men is estimated to be 64,000 (although there is a shortage of about 4000) it appears that in 1918 a total of about 77,000 men will be needed to man the fleet.

As matters stand now the intention is to retain the four-year term of service in the navy; only such persons as are sole supports of their families will be excepted, and they will serve three years during which time their families will be given a daily money allowance of 75 centimes.—*Mitt. aus dem Geb. des Seew.*

COMMENTS ON FRENCH NAVY.—The actual course of events is once more confirming the incompatibility which exists between the essentially instable political institutions of Republican France and the requirements of naval power, which are, first of all, stability and competence in their direction. Despite the Lapeyrère program, so confidently greeted as the com-

mencement of a new era; despite also the Agadyr and Manouba humiliations, the naval policy of the country is seen to be to-day at the mercy of incompetent civilian Ministers just as much as it was at the time of M. Pelletan, which, of course, precludes the possibility of lasting improvements, and condemns the Republican Navy to a ceaseless repetition of the spasmodic and, in the end, fruitless efforts that sum up its history. At the moment when the best expert opinion is presiding over the rapid development of the fleets of neighboring monarchies, there is something highly amusing or irritating, according to the standpoint from which it is viewed, in the spectacle of the carefully elaborated program of our Conseil Superieur being modified and delayed to suit the whim of a well-intentioned but ephemeral Minister who may at any time have to make room for some other politician, he also with personal ideas as to the classes of ships to be built, and whose first care will be to undo whatever his predecessor might have found time to do. So long as so truly absurd a system endures the Gallic fleet will lack the primary condition of efficiency, and will continue to give inferior return relatively to the expenditure it entails.

Uncertainty prevails as to the exact figure to which the estimates for the present year will be ultimately reduced, as well as to the fate of the projected Tourvilles. Designs have been ordered to be prepared for an improved British Tiger type of battle-cruiser to displace from 30,000 to 35,000 tons, and steam 35 knots, at the same time as the merits of such a craft are being advertised in semi-official service journals. The strategic and tactical advantages of speed are being insisted upon, and the importance is emphasized of excelling the fine *Lutzows* and *Dandolos* of Germany and Italy. The misfortune is that French naval men have not forgotten the costly blunder made with our 19 croiseurs-cuirassés, that have absorbed 550,000,000 francs and represent so little strength, and are firmly opposed to any further sacrifice to speed, especially in what concerns the plans of the five battle units that remain to be ordered under the naval program.

Minister Monis may, however, do good work in what concerns the flotillas. Whilst granting to the battleship the primary importance that rightly belongs to that type, his predecessors have rather neglected destroyers and submarines. In contrast with the British and German Admiralties, which have ordered since 1910 79 and 48 destroyers respectively, France has in the same interval been satisfied with placing 21 in hand, a number excelled by Italy alone (26). A new policy is likely to be inaugurated in this direction. The demand is for two types of boats, viz.: (1), super-destroyers of 1400-1600 tons to be superior in speed and armament to their rivals of the Triple Alliance and play the rôle of mother ships and scouts, and (2), in greater number, improved *Voltigeurs* of 500 tons and 30 knots to act as "torpilleurs d'escadre" and form the bulk of seagoing flotillas. It is also the intention to organize without delay the naval aeronautical branch, now existing mostly on paper. Tenders for dirigibles and improved waterplanes are being considered, and volunteers for the aerial branch are being invited, whilst unprecedented activity prevails at the Frejus Naval Aerodome.

No less than ten promotions to flag rank will be made in 1914, to the benefit of the vigor and professional value of the high command, which is, with every succeeding year, gaining in experience and military efficiency. A valuable addition will be made to the list of vice admirals in Rear Admiral Gauchet (56 years of age), who commanded with conspicuous success a division of the Premiere Escadre, and is mostly responsible for the splendid results of battle practice attained in 1913. The same thing is true also of Rear Admiral Favereau (57), who displayed initiative and activity at the head of the Channel cruiser squadron and flotillas. As to the future rear admirals, Mons. Monis, who has just declared himself a partizan of

young and energetic commanders, has the possibility of making excellent selections, especially since captains under Commander-in-Chief de Lapeyrère are periodically given opportunities of handling battle divisions at sea and are, consequently, better prepared than before for the duties of flag rank.

Speaking recently in the Paris Sorbonne, Rear Admiral Darrieus stated that, contrary to the popular opinion, the fighting value of fleets was measured, not by the weight and rate of fire of their broadsides, but by the "force morale" to be derived from hard and realistic preparation for war and from the confidence of crews in their weapons and chiefs. With the authority which attaches to the positions he has held as Chief de Cabinet of Minister Baudin, and as a member of the Conseil Superieur, he proceeded to affirm that the French fleet was, in this respect, in excellent condition and better prepared for emergency than at any time in the past.—*Naval and Military Record.*

GREECE

"SALAMIS."—The battleship *Salamis,* laid down for Greece in the Vulcan dockyards at Stettin in July, 1912, is almost ready for launching. The contract at first called for a ship of 13,500 tons, but the experience gained in the Balkan War, having shown that a battleship of this size was not equal to the needs of the country, caused the original plan to be changed in favor of a displacement of 20,000 tons.

The *Salamis* will be fitted with Curtiss turbines of 40,000 horse-power, giving her a speed of 23 knots. Her principal armament will consist of eight guns of 350 mm., 45 caliber; but there will be supplementary strength of 12 guns, 150 mm.; and 12 guns of 75 mm. The thickness of the water-line armor belt will be 250 mm. which will be equal to the thickness of the turrets. Guns and armor will be furnished by The Bethlehem Co. of the United States.

The dimensions of the *Salamis* will be: Length, 170 meters; beam, 24.06 meters; draft, 7.50 meters.

The *Hamburger* correspondent rumors that the Vulcan Company has also orders for the construction of some destroyers for Greece, but this is uncertain.—*La Vie Maritime.*

It is announced that the Minister of Marine would have been removed for having in advance communicated to a German construction company the detailed program for the construction of two proposed battle-cruisers, giving thus a tremendous advantage to this German company over other competitors. However, official announcement is now made that the government intends to authorize the construction of one of these battle-cruisers by a German company and to provoke bids for the other ship from other nationalities. These two battle-cruisers are to complete a division of four units of which the first two are the *Aweroff* and the *Salamis.*—*Le Yacht.*

PROGRAM OF NEW CONSTRUCTION.—The Athens correspondent of the *Times* states that the British naval mission to Greece, headed by Rear Admiral Mark Kerr, has recommended the following program of new construction: Two light armored cruisers of an improved *Arethusa* type, displacing 5000 tons; four destroyers, six submarines, and ten seaplanes. Support is also given to the proposal, emanating from the Greek Government, to lay down another battleship in addition to the *Salamis,* now under construction in Germany.—*The United Service Magazine.*

GERMANY

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Grosser Kurfurst	26,575	23	10 12-in., 14 5.9-in., 4 t. t.	Hamburg	Launched May 5, 1913
Markgraf	26,575	23	same	Bremen	" June 4, 1913
König	26,575	23	same	Wilhelmshaven	" Mar. 1, 1913
Ersatz Brandenburg	26,575	23	same	Germania	Laid down Dec., 1912
Ersatz Worth			8 15-in., 16 5.9-in.	Kiel	Laid down July, 1913
"T" 1913			same	"	.....
Cruisers of the Line					
Ersatz Kaiserin Augusta	28,000	30	8 12-in., 14 6-in.	Dantzig	Laid down Sept., 1912
Derfflinger	28,000	27	same	Hamburg	Launched July 1, 1913
Ersatz Hertha			....	Wilhelmshaven	Laid down July, 1913
Lutzow			....	"	Launched Nov. 29, 1913
Protected Cruisers					
Karlsruhe	4,900	28	12 4.1-in., 2 t. t.	Germania	Under trials
Rostock	4,900	28	same	Howaldt	same
Ersatz Irene	4,900	27	10 6-in.	Bremen	Laid down
" P. Wilhelm	4,900	27	same	Kiel (Kaiserliche)	" " Oct. 23, 1912
Graudenz			....	"	Launched Oct. 25, 1913

NEW BATTLESHIPS.—In the course of the year 1914 there will probably be placed in commission the three battleships: *Markgraf* (Weser Company), *Grosser Kurfürst* (Vulcan, Hamburg), and *Koenig* (Imperial Dockyard, Wilhelmshaven). They will go to form the third squadron to which the *Brandenburg* will be assigned upon her completion, which will be about a year later.

The armored cruiser *Ersatz Hertha* is to be an improved *Derfflinger* type; displacement about 26,000 tons; speed, 28 knots; armament, eight 30-cm. and fourteen or sixteen 15-cm.; the *Ersatz Kaiserin Augusta* will be of a similar type. From the comparatively light battery one may judge that extra weight is to be put into oil-carrying capacity and deck armor.

S. M. S. *Graudenz* was launched at Kiel on October 25, 1913, being the twentieth ship that has been built by the Imperial dockyard at Kiel, and the thirty-third of the modern small cruisers of the German Navy. As a comparison the following dimensions are interesting as showing the improvements of these latest small cruisers over the first ones (*Gazelle* class) in speed, armament and steaming radius:

	Latest	Earliest
Displacement	5000 tons	2650 tons
Speed	27.5 knots	19.5 knots
Radius	5500 miles	4000 miles
Armament	twelve 10.5-cm., 45-cal.	ten 10.5-cm., 40-cal.

—*Marine Rundschau.*

SUBMARINE CONSTRUCTION.—The German Admiralty is reported to have ordered a submarine for experimental purposes from the Fiat-San-Giorgio Company, of Spezia. This Italian firm has supplied submarine designs to several navies, including the British, and a submarine now building by Messrs. Scott's Shipbuilding Co., of Greenock, is of the Laurenti type as constructed as Spezia. The twenty-second German submarine was reported to have been launched at Danzig in November. Guns are now being mounted by the later vessels, the weapon adopted being a 14-pounder.—*Journal of Royal Naval Service Institute.*

THE TREND OF GERMAN WARSHIP DESIGN.—The German Navy estimates for 1914 provide for a total expenditude of £24,397,600, and, although it is difficult to make effective comparison with the figures of the previous year, owing to the method of arranging the details, it would seem that there is a substantial increase, because there was provided in the estimates of the current year £22,887,870, and for the past year £22,464,686. Present indications point to the laying down, in accordance with the navy law, of one battleship, one battle-cruiser, two small cruisers, and a flotilla of torpedo-boats for the replacement of obsolescent craft. The provision made for submarine boats is £950,000, which is practically the same as in the current year, while for airships and aeroplanes the estimated expenditure is £422,500. Provision is also made for adding to the oil-fuel storing facilities. Perhaps, however, the most interesting new feature of the German naval policy is the greater freedom with which indication is given of the outstanding features of the design of the new ships. The more liberal information enables a more authoritative estimate of the trend of German naval design to be made, in a chapter contributed by Mr. Bywater, of Berlin, to this year's issue of the *Navy League Annual*, which, under the painstaking and well-informed editorship of Mr. Alan H. Burgoyne, maintains the high standard of previous years. Mr. Bywater, from his long residence in Germany and his close study over a period of years, is in an especially advantageous position for acquiring knowledge as to design.

Formerly the fundamental aim in the shaping of German policy seems to have been directed to the attainment of a limited number of ships of moderate dimensions and cost, carrying a large installation of relatively light, but rapid-firing guns, thoroughly and continuously prepared for war. The idea was that such a fleet would be more effective than a larger navy with ships individually superior, but collectively less prepared for war. Thus many of the earlier German ships had a main armament limited to four 9.4-inch guns, firing 420-pound shells. After the Chino-Japanese War the ammunition allowance was enormously increased, the allowance per annum for firing exercise giving then one German ship as much ammunition as three British ships. The attention devoted to target practice was very great. Firing commenced at 5000 yards, but the vessels were required subsequently to draw closer on the target, in order to increase the punishment; rapidity of fire was looked upon as of great importance. All this was consistent with the policy, as quoted by Mr. Bywater, that Germany "saw clearly enough that only by a sudden, stunning blow, delivered with every ton of material behind, could a small navy hope to succeed against the overwhelming array of ships that her prospective antagonist could marshal if allowed time to mobilize his own force."

It is recognized in Germany, however, that as a result of the complete reorganization of the British fleet, which began six or seven years ago, our state of preparedness for war has been so improved, alike in organization, ammunition supply, efficiency, and *personnel*, that our paper superiority could be converted into effective superiority even at the outset of a war. Moreover, the battle of Tsushima "has taught that not the quick-firer, but the big gun was the decisive factor in naval combat." Germany therefore had to reverse her policy; but, according to Mr. Bywater, she did not at once achieve the equality of ship desired, because of the continued reliance on the view that the 11-inch and 12-inch Krupp guns compared with the

13.5-inch and 14-inch guns of foreign make. But the ships laid down this year will be fitted, like our *Queen Elizabeth* class, with a main battery of eight 15-inch breech-loading guns, and with a secondary battery of sixteen 6-inch quick-firing guns. The speed, however, is still to be only 21½ knots, as compared with 25 knots in the five British ships of the class. This advance is at least significant, because for some time there have been well-informed criticisms in the German technical press pointing out the inferiority of German as compared with British battleships. Captain Persius and Captain von Kühlwetter were notably cogent critics, particularly in regard to the *König* class now being completed. Taking contemporary ships laid down in 1907, the British ships were shown to have had a superiority in each salvo of guns of 1520 pounds of metal; in the ships laid down in 1909 our superiority was 1620 pounds; in the vessels laid down in 1910, 3900 pounds; in the *King George V* class, 5400 pounds over the *König* type and in the *Queen Elizabeth* class, laid down last year, 7000 pounds over the *Ersatz Bundeburg*.

The superiority has thus steadily advanced to a ratio equal to about 80 per cent, notwithstanding that in nearly every instance the British ship was laid down earlier than the German vessels of the same year. There has always been the contention that in taking salvos the rate of fire was not considered, and that the lighter guns in the German ships, in view of the greater rapidity of fire, would compare favorably with the heavier guns in the British ships; but it is found in practice that there is very little difference (if any) in the rate of fire from guns exceeding 9-inch bore, largely because with the salvos there is such a disturbance of the atmosphere that a period of time must elapse in order to secure accuracy of aim. This applies even where the "director" system of control is adopted and when the position for directing the training of a gun is located at a high elevation. Apart altogether from this, there is the fact that according to one authority "it is the constant pounding, pulverizing and splitting of frames and armor backing, the straining open of seams, the shattering of bulkheads, and the destruction of the water-tightness of the whole, which eventually sink the ship." Thus, the attack by a 1250-pound projectile of the 13.5-inch British gun is likely to do much more serious damage than the 860-pound from the German 12-inch gun. On the question of the greater durability of the Krupp naval gun and the British wire-wound model, Mr. Bywater says that, after being privileged to examine relative statistics on this point, he is satisfied that the claim is exaggerated, if not entirely unwarranted.

The current issue of *Nauticus*, the semi-official German year-book, gives figures as to the thickness of the armor protecting the water-line of the German ships, and on this point the comparison seems to be in favor of the German ships. The first of the German dreadnoughts were provided on the water-line with 11.4-inch armor, the *Kaisers*, laid down in 1911, with 13.75-inch armor, and this year's ships with 15-inch armor. The 12-inch gun might not penetrate this belt, but the 13.5-inch projectile, and especially the 15-inch shell of 1950-pounds weight, would easily defeat it. No information, however, is given as to the length of this main belt, nor of the protection of other parts of the ship. Similarly, the thickness of the armor on the earlier battle-cruisers laid down in 1909 was 9.8 inches, and of the later ships 11 inches, and here again the German ships seem to have an advantage; no information, however, is given as to the length of the belt or the effectiveness of the armor in other parts of the ship. Obviously, if the armor is throughout more effective, greater weight is thereby involved, and compromises must have been made in other elements of design. It may be that by increasing the air pressure in the stokeholds the speed is got for a less weight of machinery than in British ships of the same class; but, if so, the full speed is probably less reliable than under British natural-draft conditions.

In the German battle-cruisers there is inferiority in the power of attack, because although our cruiser, the *Lion*, laid down in 1910, had eight 13.5-

inch guns, it is only now that in the German ship *Derfflinger* the caliber has been increased to 12 inches, the number of guns being eight. The same armament, according to *Nauticus*, is to be given to the cruisers laid down in 1912-13. In the future battleships, on the other hand, there will be, according to Mr. Bywater, ten 15-inch breech-loading guns in two triple and two double turrets on the center line, the guns in Nos. 2 and 3 turrets being at a higher level, so as to fire over the turrets Nos. 1 and 4. The secondary battery will be increased to eighteen or twenty 5.9-inch quick-firing guns, so that it would appear that the 6.7-inch quick-firer, in the case of some of the ships now being completed, is being abandoned. Mr. Bywater says that "as mounted in the *Braunschweigs* and *Deutschlands* this model has been a complete failure, owing to the excessive weight of the ammunition, which reduces the service rate of fire to something like 2½ rounds per minute. The new Krupp 8.2-inch 50-caliber model has also been mentioned as a likely gun for the secondary battery of future ships; but its employment in such a capacity is not advocated in responsible quarters." As regards the light cruisers, the suggestion is made that the automatic multiplication of such ships under the terms of the navy law, although impressive on paper, has in reality its disadvantages, because there is less time for studying the progress of the same class in other navies; and thus, it is said, that vessels of this class being built in Germany, which are obviously intended to act as scouts or destroyers of torpedo craft, are defective in armament. The fastest vessel of this class is the *Strassburg*, her mean speed during a six hours full-power run having been 28.28 knots with 33,742 short horse-power, the displacement of the vessel being 4500 tons, her armament twelve 4.1-inch guns, and her armor protection a narrow 4-inch belt amidships.—*Engineering*.

DEVELOPMENT OF SUBMARINE BOATS AND THEIR ENGINES.—Premising that submarine boats have to be able to run at the surface as well as at considerable depths below it, the author first reviewed the different apparatus that had to be provided to meet the different conditions of service. When a boat was at the surface, from 15 to 35 per cent of her volume was emerged. To enable her to dive, her remaining buoyancy had to be overcome by the filling of diving or ballast tanks with water and these had to be so arranged that their filling did not alter the trim. To prevent the vessel from at once sinking when the tanks were filled, a certain residue of "reserve buoyancy" was provided for. Inasmuch as the boat might have to operate both in fresh and in salt water, additional "aid tanks" were filled in the latter case, these also having to be so arranged as not to interfere with the trim. A trim tank, usually half filled, was arranged at each end of the vessel, and means were supplied for transferring the water from the one to the other. Then there were adjusting tanks, the use of which was to make up the weight lost by the consumption of provisions and stores, as well as by the firing away of torpedoes. The loss of weight by the consumption of oil was rather more than balanced by water which was allowed to enter the bunkers, and on the surface of which the oil floated.

For diving, arrangements had to be made for the release of the air and for the rapid entrance of the water into the tanks. This maneuver, which had to be accomplished in five minutes at most, was assisted by the action of diving rudders arranged forward and aft. The tanks were emptied either by pumping or by the use of compressed air, and large quantities of the latter had for different purposes to be stored on board. As an example, a boat of 600 tons might have diving tanks of 240 tons capacity, which had to be filled or emptied in the short time referred to. High-pressure air pumps provided the stores of compressed air thus expended. To ensure a sufficiency of stability, a distance of the center of gravity below the center of buoyancy in the immersed condition of the vessel of from 6 inches to 1 foot was looked on as sufficient. It was sometimes as great as 16 inches.

The salient feature of all the Laubeuf, the d'Equevilley-Germania and the Laurenti-Fiat designs was the strong cylindrical, or nearly

cylindrical, main hull. On and round about the latter the three last-mentioned designs showed water-tight and non-water-tight tanks and erections of various kinds. It was pointed out that in the "Holland" type the capacity of the internal tanks was restricted to a possible 15 per cent of the surface-trim displacement. In two of the designs the externally arranged tanks were shown to have a capacity of 30 to 35 per cent of the surface-trim displacement. In one of the Germaniawerft boats the external structures were so arranged that the vessel took the outline form of an ordinary ship. The external structures being either non-water-tight or filled with water in the immersed condition of the vessels, they could themselves be of light construction. They were strongly attached to the main hull by bulkheads, web frames, etc.

In a comparison between the so-called "submersibles" and ordinary submarines, it was pointed out that the former could have more reserve buoyancy, better sea qualities and more comfortable quarters, and were safer in cases of collision or other such accident. On the other hand, it was pointed out that the under-water speeds attainable with the "submarines" were somewhat the greater; for surface work they were at a disadvantage in this respect. Curves of speed and power of a submarine and of a submersible triad some years ago in the tank showed a remarkable hump-and-hollow formation and a general excess of resistance of the former for surface runs. The under-water speed of the submarines was 9½ knots and that of the submersible 9 knots. Attention was called to the circumstance that the propeller was necessarily a compromise between the very different designs suitable for surface run and under-water run respectively.

A succession of pictures thrown on the screen included one of a Germaniawerft boat, which was stated to have behaved exceedingly well during a bad weather run in the North Sea. This vessel had a ship-shaped outline with a small forecastle, and it appeared that her designers had sacrificed a moderate percentage of speed on under-water runs for improved sea conditions during the surface work. The maximum speeds hitherto attained were, the author said, about 15½ knots on surface runs and 11 knots in under-water work; but recent offers from builders had proposed to raise these to 18 and 11½ knots, and anticipated the attainment of radii of action of 2000 nautical miles at 16 knots and 30 nautical miles at about 8½ knots respectively.

Considerable space was given to the main engines of submarine craft, classed under the heads of installations with (1) electric accumulators, electro-motors and oil engines; (2) steam machinery; (3) steam engines with soda boilers; and (4) compressed air in nickel-steel flasks, underwater propulsion in this case being effected by oil engines. Of these designs, that with steam engines and soda boilers was gone into in some detail by the aid of sketches, which, unfortunately, cannot be reproduced here. The installation comprised: (1) Water-tube boilers with oil firing for surface work; (2) steam engines with auxiliary engines, condensers and pumps; (3) a tank or tanks for hot water; and (4) a pair of so-called double boilers, each with a middle compartment for soda lye, and two water-tube end compartments.

For the under-water run steam from the low-pressure cylinder was turned into the middle compartments of the double boilers. The soda lye took up the latent heat of the steam, and further heat was developed during the chemical change which it thereby underwent. Water from the condenser was meanwhile introduced into the end compartments of the double boilers, and this was further supplemented and brought up to a working level by a supply of water from the hot-water tanks. The lye in the middle compartments became greater in volume and more and more diluted, and the pressure here increased till the exhaust steam had to be in part passed into the intermediate cylinder. Finally, the supply of exhaust steam to the lye compartment had to be entirely cut off, and the under-water

run came to an end. It was necessary to arrange the installation in such a way that the process did not cause alterations in the trim of the vessel.

A design of the Actiengesellschaft "Weser," of Bremen, on this principle showed very favorably as regards accommodation. The author expressed a fear that high temperatures in the working spaces would cause trouble. Assuming this difficulty got over, he gave a favorable forecast of the probable performances of such boats, but was careful to point out that no exact figures were as yet obtainable. The general expectation with regard to speeds was that the surface forced-draft runs and the under-water runs would show considerable advances on performances hitherto recorded, while the radii of action at the cruising speeds would be reduced.

A design of Mr. Del Proposto, in which an oil engine was used both for surface and for under-water runs, in the latter case in connection with highly compressed oxygen, gave promise of high speeds but the materials of all parts of the engine installation were considered to be stressed to a dangerously high degree.

Diagrams giving the comparative merits of the different systems with regard to weight, space, and under-water output showed in favor of that with compressed oxygen.

Direktor Keuffel, of the Actiengesellschaft "Weser," who rose to discuss the paper, said that the thanks of his company were due in a high degree to the Torpedo Inspection Authorities for their critical examination and favorable recognition of the good results achieved. In their endeavors to improve the submarine boat they had to give their attention mainly to the motive installations. Here, as elsewhere, in warship work they were accustomed to find that people would not rest satisfied with their economical successes, because engineering requirements generally ran on ahead. The experimental trials of soda boiler installations for submarine boats made by the Actiengesellschaft "Weser" had shown that a further development of these vessels, as desired by the naval authorities, could probably be effected on these lines. Calculation and preliminary trial had revealed the presence of many points of advantage of the soda boiler installations over the oil-electric ones. He did not wish to make too much of the advantages of their motor, but the advantages of the steam installations should also not be taken too lightly. It would be noticed that the rapidly developing oil motor had in this case to allow the steam engine to keep its place, but the presence of the soda boiler installation enabled the accumulator battery and the second power installation to be done without. Consideration must now be given to the question, How far it was possible to go with the forcing of the boiler and of the installation generally? More could be expected from the soda boiler than Herr Berling in the meantime thought it right to assume. It would not be right to remain content with the oil-electric installation, and it was all the more matter for congratulation that the Torpedo Inspection Authorities had given their attention to his company's projects and proposed to follow them up.

Herr Irinyi, of the Deutsche Oelfeuerungsgesellschaft m. b. H., of Hamburg, upheld the cause of oil fuel. As a result of a life's work, he referred to a design of his own for an engine installation of a submarine boat, with which, he said, higher requirements could be fulfilled. He pleaded for the appointment of a committee of experts chosen from the navy and from the Schiffbautechnische Gesellschaft to examine this as yet unpatented design and form a judgment as to its value. The design was based upon a study of the combustion process in the Diesel motor, which had, in his opinion, not yet been properly developed. The supply of air had hitherto been 80 per cent greater than that theoretically required. With a smaller excess of air, which his design rendered possible, smaller compression spaces also were required. With oil firing a supply of air only one-tenth greater than the theoretically required quantity became effective. The performance could therewith be improved by from 40 to 50 per cent. With a reduced excess of air supply a smaller store of air sufficed for the installation, or,

if the store were maintained, it became possible for the boat to remain longer under water. Either smaller engines could be provided for the powers or greater powers could be attained with the cylinder volumes hitherto in use.—Extracts from a paper read by Marinebaurat J. Berling of Kiel, June 6, 1912.—*The Engineer.*

THE DEVELOPMENT OF THE SUBMARINE BOAT PERISCOPE.—As an historical fact it has been set forth that a submarine boat sight tube was invented in 1854 by Marié Davy. About fifty years later such tubes had begun to take practical shape. Dr. Weidert traced the development of the appliance from the vertical tube with inclined mirrors at top and bottom, on the lower one of which an image reflected on the upper one could be seen through various arrangements of prisms and lenses, to the perigraph—afterwards called "periscope"—of the French Colonel Mangin. This was essentially a ring-shaped mirror, which enabled photographic panoramic pictures to be made right round the horizon. When this was applied to the top of a sight tube of a submarine the picture was reflected downwards on to a mirror within the vessel. Inasmuch as the ring pictures were small and distorted, an arrangement had to be made by which a disc picture of any desired piece of the horizon could be reflected into the space within the ring picture. The round view of the horizon was obtained partly at the expense of the disc picture, which was reduced in size by the width of the ring, and it was considered doubtful whether this arrangement would maintain its ground.

Binocular sight tubes, which were subsequently tried, necessitated either an increase of the diameter of the tube or a reduction in the size of the picture. A field glass arrangement was then fixed at the bottom of the tube, the observer, as before, looking horizontally at the prism there fixed.

To determine the magnetic azimuth at which an object appeared from the submarine a compass was fitted in the head of the sight tube. An attendant advantage of this was that the compass was in this position least affected by the steel masses of the vessel's structure. An arrangement could also thereby be made such that the observer at the sight tube could at the same time keep the course, steered by the submarine, under observation.

The distance of objects of known dimensions from the submarine was determined by so-called telemeter plates, which were graduated vertically and horizontally in hundredths. If an object under observation measured 5 graduations, its distance was 100 times the corresponding real dimension divided by 5. Several variations of this system were stated by Herr Weidert to be in use or proposed. In the double picture micrometer arrangement two pictures of the same object cut each other in the lens. The pictures could be shifted with reference to one another till, say, the top of the funnel of a ship under observation in the one picture was level with the water of the other. The amount of shift necessary for this thus served as a scale for the measurement of the distance. An appliance for such measurement was illustrated. The sight tubes ranged up to 23 feet in length and between 3 inches and 6 inches in external diameter.—*Engineer.*

SOUTH ATLANTIC CRUISE.—The battleships *Kaiserin* and *Koenig Albert* and the cruiser *Strassburg* were to leave Germany early in December for a three- or four-months cruise in South Atlantic waters.

GREAT BRITAIN

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Benbow	26,000	22	10 13.5-in., 16 6-in.	Beardmore	Launched Dec. 12, 1913
Emperor of India	26,000	22	same	Vickers	" Oct. 27, 1913
Iron Duke	26,000	22	same	Portsmouth	" Oct. 12, 1912
Marlborough	26,000	22	same	Devonport	" Oct. 24, 1912
Qu'n Eliz'b'h	27,500	25	8 15-in., 16 6-in.	Portsmouth	" Oct. 16, 1913
Warspite	27,500	25	same	Devonport	" Nov. 26, 1913
Valiant	27,500	25	same	Fairfield	Laid down Jan. 31, 1913
Barham	27,500	25	same	Brown & Co.	" " Feb. 24, 1913
Roy'l Sover'gn	25,500	27	.....	Portsmouth	
Royal Oak	25,500	27	.....	Devonport	
Resolution	25,500	27	.....	Palmer	
Ramillier	25,500	27	.....	Beardmore	
Revenge	25,500	27	.....	Vickers	
Battle Cruisers					
Tiger	30,000	30	8 13.5-in., 12 6-in.	Brown & Co.	Launched Dec. 15, 1913
Light Cruisers					
Nottingham	5,400	25	9 6-in., 4 3-pdrs.	Pembroke	" April 18, 1913
Birmingham	5,400	25	same	Elswick	" May 7, 1913
Lowestoft	5,400	25	same	Chatham	" April 23, 1913

H. M. S. "IRON DUKE."—(See frontispiece of this number.) The new battleship *Iron Duke*, which was built at Portsmouth, and carried out her official gunnery trials on December 4, carries ten 13.5-inch guns as her main armament, besides a strong battery of 6-inch guns as the anti-torpedo armament. On leaving Spithead the *Iron Duke* proceeded to the southeast, returning to the anchorage in the evening, and, although no official report was made, it is stated that the trials proved very satisfactory. The huge weapons were tested with half and full charges under the ordinary conditions, and the secondary armament was also tested. Next morning the torpedo trials were carried out. The *Iron Duke* went into Portsmouth harbor to complete for commission, and it is expected that she will be ready early in January to replace the *Neptune* as flagship of the commander-in-chief of the home fleets. Her armor belt amidships is 13½ inches thick, the turret armor 10 inches thick, and that of the secondary battery 8 inches thick. There is also special protection against aerial attack, crowns to magazines, etc., but of this, of course, no particulars are available. The vessel is fitted with submarine telephones.

The *Dreadnought* of 1906 had a length of 490 feet and a displacement of 17,900 tons. This steadily increased until the *Orion* was launched in 1910, 545 feet long and of 22,500 tons displacement. The *King George V*, of the following year, was 10 feet longer and of 500 tons more displacement. The *Iron Dukes* are 580 feet in length and of 25,000 tons displacement; and the *Queen Elizabeth* class, which follows, is 600 feet long, with a displacement of 27,500 tons. The beam has increased in almost the same proportion, and the breadth has now reached 90 feet 6 inches. Throughout, however, it has been found necessary to minimize the draft as far as possible.

The *Queen Elizabeth* will have two funnels instead of one, as at first reported.—*The Engineer.*

"INVINCIBLE."—The British Government has come to the conclusion that it has made a costly failure in fitting the battle-cruiser *Invincible* solely with electricity. She has been sent to the dockyard to have hydraulic power

substituted for electricity for the working of the guns, and it is stated that this will cost about $1,000,000. The vessel was the only ship in the British Navy fitted with electric power throughout.—*Washington Star.*

"ROYAL SOVEREIGN."—The first keel plate of the battleship *Royal Sovereign,* to be built at Portsmouth, was laid on Thursday, January 15. Nothing is certainly known about the special features of the *Royal Sovereign* and her sister ships, but it is generally supposed that they will be smaller than the *Queen Elizabeth* and that they will burn coal, oil being carried as auxiliary fuel.—*The Engineer.*

"AJAX."—The battleship *Ajax,* the twenty-sixth British vessel of the dreadnought type, was commissioned at Devonport by Captain Sir Arthur J. Henniker-Hughan for service in the second battle squadron of the home fleet (which, when she is added, will consist entirely of super-dreadnoughts, all able to fire ten 13.5-inch guns on the broadside). The new ship belongs to the 1910-11 naval program, and is a sister vessel to the *King George V* and *Centurion,* which are already in commission, and to the *Audacious,* about to be passed into service. The *Ajax* and *Audacious* are each nine months in arrear. The *Ajax* was laid down at Messrs. Scott's, Greenock, on February 27, 1911, and was launched on March 21 last year. She is 555 feet long and 89 feet in beam, the normal displacement being 23,000 tons. Turbine engines of 31,000 horse-power were designed to give a mean speed of 21.5 knots, but although the maximum of 22.5 was reached on the measured mile, the mean of the eight hours trial was 21.07 knots only. She is protected by an armor belt having a maximum thickness of 12 inches, and her armament consists of ten 13.5-inch guns of the improved type, firing shells of 1375 pounds, and sixteen 4-inch are mounted for defence against torpedo attack. Three 21-inch torpedo tubes are also mounted. The estimated total cost of the vessel is £1,916,330.—*United Service Gazette.*

BATTLESHIPS BEGUN.—Work upon the three contract-built battleships of the current shipbuilding program has now been actually begun. These were the vessels which the First Lord announced on June 5 last were to be accelerated in view of the situation created by the rejection of the Canadian Naval Aid Bill. Orders were then issued by the Admiralty that the ships should be begun at the earliest possible date instead of in March, 1914. The *Ramillies* was laid down at Dalmuir by Messrs. Beardmore on November 12, immediately following the launch of the *Benbow.* The keel of the *Resolution* was laid by Messrs. Palmers at Jarrow on November 28, on the same day that the keel of the *Murray,* destroyer, was laid at the same yard. The *Revenge* was reported to have been begun at the Vickers' yard, Barrow, in the same week.—*Journal of Royal Naval Service Institute.*

"BENBOW" AND "RAMILLIES."—The event of greatest note in Clyde shipbuilding during November was the launch, on November 12, from the naval construction works of Messrs. William Beardmore & Co., Dalmuir, of H. M. S. *Benbow,* one of the British dreadnought battleships of the 1911-12 program, and the heaviest warship yet constructed on the Clyde. The *Benbow* launch was rendered additionally notable and impressive in that it was promptly followed by the laying upon the berth just vacated of a large section of the keel structure of the battleship *Ramillies,* a new and larger vessel, commenced under the 1913-14 navy estimates. This vessel is to be the same length as the *Benbow* (580 feet B. P.), but slightly broader and deeper, the displacement being increased to nearly 26,000 tons. About 100 feet length of keel structure—weighing about 300 tons—had been suspended from overhead cranes, and immediately the *Benbow* left the ways and became waterborne the keel structure was lowered into place and secured on the keel blocks. While this is not quite unique in naval shipbuilding practice—launching and keel-laying having been simultaneously carried out, for example, by Mr. A. J. Campbell, the manager at

Dalmuir, while engaged in the management of naval shipyards in Spain—the promptitude and expedition of the achievement in this case form a record. It may also be recorded of the *Benbow* that she is essentially a Scottish production, practically all the material used having been prepared at Messrs. William Beardmore & Co.'s Parkhead Works. In this connection it is interesting to note that there was despatched from the Parkhead Works, via the Caledonian Railway, to Woolwich during the first week in November the largest naval gun ever made in Scotland. This is a 15-inch weapon, weighing about 100 tons and with a length of about 65 feet, and forms the first portion of an order for similar guns for the *Queen Elizabeth* type of battleships.—*Shipbuilding.*

THE BATTLE-CRUISER "TIGER."—His Majesty's ship *Tiger,* launched from the yard of Messrs. John Brown & Co., Ltd., at Clydebank, is expected to be capable of maintaining for long periods a speed of twenty-eight knots. Her dimensions are 660 feet in length between perpendiculars, and 90 feet 6 inches in beam, while on the mean draft of 28 feet 6 inches she will displace about 28,500 tons. The propelling machinery will consist of Brown-Curtiss turbines, and it is believed that it will have novel features. Estimates of the horse-power which may be developed vary between 85,000 and 100,000, and this power would render the vessel the fastest armored warship afloat. Provision will be made for the burning of both coal and oil fuel. This will enable the maximum speed of the vessel to be maintained for a much longer time than would otherwise be the case. The armor protection of the *Tiger* is also assumed to be another of her strongest features. Her armament will consist of eight 13½-inch guns, twelve 6-inch guns and two 21-inch submerged torpedo tubes. After the *Tiger* is placed in commission, the first battle-cruiser squadron will consist of four homogeneous ships—*Lion* (flagship), *Queen Mary, Princess Royal* and *Tiger.*—*Page's Engineering Weekly.*

"BIRMINGHAM."—During the past month the light cruiser *Birmingham,* built by Sir W. G. Armstrong, Whitworth & Co., at Elswick, has carried out her steaming and gunnery trials, and is now being prepared for delivery to the British Admiralty. Laid down on June 10, 1912, and launched on May 7, 1913, the vessel is 430 feet, by 49 feet 10 inches, by 15 feet mean load draft, with a displacement of 5440 tons. Her main armament consists of nine 6-inch B. L. guns with new and improved gun mountings, designed and manufactured by the Coventry Ordnance Works, Ltd. The Parsons' turbine propelling machinery, supplied by Messrs. R. & W. Hawthorn, Leslie & Co., St. Peter's, was designed to develop a shaft horse-power of 25,000 and give the vessel a speed of 25.5 knots. It is understood, however, that both the power and speed named were considerably exceeded on the vessel's full-power trial.—*Shipbuilding.*

Victor (t. b. d.), this new ocean-going torpedo-boat destroyer, the fourth of her type, building by Messrs. John I. Thornycroft & Co., was launched from Woolston Yard on the 28th ult. This destroyer is about 260 feet long and 26 feet 6 inches beam, and is fitted with Parsons' turbines and water-tube boilers burning oil fuel.—*Army and Navy Gazette.*

NEW DESTROYERS.—The Admiralty have placed orders for the construction of all the sixteen destroyers provided for under the present year's program, with the exception of the *Menace, Marskman* and *Monitor.* The *Manly, Minos* and *Miranda* will be built by Messrs. Yarrow & Co., of Scotstoun; the *Milne, Moorsom* and *Morris,* by Messrs. J. Brown & Co., of Clydebank; the *Mansfield* and *Mentor,* by Messrs. Hawthorn, Leslie & Co., Newcastle-on-Tyne; the *Mastiff* and *Meteor,* by Messrs. Thornycroft & Co., Southampton; the *Matchless,* by Messrs. Swan, Hunter & Wigham Richardson, of Newcastle-on-Tyne; and the *Murray* and *Myngs,* by Palmer's Shipbuilding Co., Jarrow-on-Tyne.—*United Service Gazette.*

H. M. S. "LAWFORD."—Torpedo-boat destroyer, for the British Admiralty under the 1912-13 naval program; 935 tons displacement. The propelling machinery consists of Parsons' turbines of 24,500 shaft horse-power, and were constructed by the shipbuilders. Launched, October 30.—*Shipbuilding.*

"LLEWELLYN."—Torpedo-boat destroyer, for the British Admiralty under the 1912-13 naval program; 935 tons displacement. The propelling machinery consists of Parsons' turbines of 24,500 shaft horse-power, and were constructed by the shipbuilders. Launched, October 30.—*Shipbuilding.*

Paragon (t. b. d.), was commissioned at Portsmouth, December 11, 1913, This is one of the last boats of the 1911-12 program (K class), and was not long since delivered by Messrs. Thornycroft. She will join the fourth destroyer flotilla.—*Navy and Military Gazette.*

Laertes (t. b. d.), originally known as the *Sarpedon,* has been commissioned for service in the new third destroyer flotilla, and has taken up her duties at Harwich. She is the first unit of the 1912-13 program to go into active service.—*Navy and Military Gazette.*

H. M. S. "LYSANDER."—This ocean-going torpedo-boat destroyer, built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at their Wallsend shipyard, has successfully completed a series of trials at sea. The trials which the *Lysander* has undergone include a twenty-four hours trial at cruising speed, an eight hours run at full power, running astern, testing the deck machinery, and torpedo-launching tubes, and also firing the guns under service conditions. She is now receiving her finishing touches and having the engines inspected, after which she will be made ready for acceptance by the Admiralty. The turbines and boilers have been built by the Wallsend Slipway & Engineering Co. The boilers are of the Yarrow water-tube type, and have oil-burning furnaces. It was found that they were able to easily maintain an ample supply of steam during all the trials. The turbines are of Parsons' impulse and reaction type, operating two propellers each on a separate shaft. Both the astern and the ahead turbines are enclosed in the same casing in each set. Steam is admitted through a series of nozzles, so arranged that a given number of them can be used according to the speed at which it is desired to drive the ship, and in this way the best economy of steam is obtained.—*Page's Engineering Weekly.*

Fortune (t. b. d.), on acceptance from the contractors about the 11th inst., is to be commissioned at Portsmouth for service in the fourth flotilla.—*Army and Navy Gazette.*

"GARLAND" (t. b. d.).—The torpedo-boat destroyer *Garland,* which has been built by Messrs. Cammell, Laird & Co., Birkenhead, from the designs of Parsons' Marine Turbine Company, carried out her official acceptance trials successfully and afterwards left for Chatham, to be commissioned with a full crew for service in the fourth destroyer flotilla. The vessel is one of the eight privately designed destroyers of the 1911-12 program, and draws two inches less water and has a displacement of 29 tons more (964 tons) than the twelve Admiralty designed destroyers of the *Acasta* class, while her speed is estimated at 30 knots as compared with the 29 knots of the latter class. The *Garland* and the other seven vessels of her class are armed with three 4-inch quick-firing guns, the *Acasta* type being armed with three 4-inch breech-loading guns. The *Garland* has a length of 260 feet, a breadth of 27 feet, and her turbines have been designed to indicate 24,500 horse-power.—*United Service Gazette.*

The *Leonidas,* launched from the Jarrow shipyard of Palmer's Shipbuilding & Iron Co., Ltd., is the first of two torpedo-boat destroyers, the

Dalmuir, while engaged in the management of naval shipyards in Spain—the promptitude and expedition of the achievement in this case form a record. It may also be recorded of the *Benbow* that she is essentially a Scottish production, practically all the material used having been prepared at Messrs. William Beardmore & Co.'s Parkhead Works. In this connection it is interesting to note that there was despatched from the Parkhead Works, via the Caledonian Railway, to Woolwich during the first week in November the largest naval gun ever made in Scotland. This is a 15-inch weapon, weighing about 100 tons and with a length of about 65 feet, and forms the first portion of an order for similar guns for the *Queen Elizabeth* type of battleships.—*Shipbuilding.*

THE BATTLE-CRUISER "TIGER."—His Majesty's ship *Tiger,* launched from the yard of Messrs. John Brown & Co., Ltd., at Clydebank, is expected to be capable of maintaining for long periods a speed of twenty-eight knots. Her dimensions are 660 feet in length between perpendiculars, and 90 feet 6 inches in beam, while on the mean draft of 28 feet 6 inches she will displace about 28,500 tons. The propelling machinery will consist of Brown-Curtiss turbines, and it is believed that it will have novel features. Estimates of the horse-power which may be developed vary between 85,000 and 100,000, and this power would render the vessel the fastest armored warship afloat. Provision will be made for the burning of both coal and oil fuel. This will enable the maximum speed of the vessel to be maintained for a much longer time than would otherwise be the case. The armor protection of the *Tiger* is also assumed to be another of her strongest features. Her armament will consist of eight 13½-inch guns, twelve 6-inch guns and two 21-inch submerged torpedo tubes. After the *Tiger* is placed in commission, the first battle-cruiser squadron will consist of four homogeneous ships—*Lion* (flagship), *Queen Mary, Princess Royal* and *Tiger.*—*Page's Engineering Weekly.*

"BIRMINGHAM."—During the past month the light cruiser *Birmingham,* built by Sir W. G. Armstrong, Whitworth & Co., at Elswick, has carried out her steaming and gunnery trials, and is now being prepared for delivery to the British Admiralty. Laid down on June 10, 1912, and launched on May 7, 1913, the vessel is 430 feet, by 49 feet 10 inches, by 15 feet mean load draft, with a displacement of 5440 tons. Her main armament consists of nine 6-inch B. L. guns with new and improved gun mountings, designed and manufactured by the Coventry Ordnance Works, Ltd. The Parsons' turbine propelling machinery, supplied by Messrs. R. & W. Hawthorn, Leslie & Co., St. Peter's, was designed to develop a shaft horse-power of 25,000 and give the vessel a speed of 25.5 knots. It is understood, however, that both the power and speed named were considerably exceeded on the vessel's full-power trial.—*Shipbuilding.*

Victor (t. b. d.), this new ocean-going torpedo-boat destroyer, the fourth of her type, building by Messrs. John I. Thornycroft & Co., was launched from Woolston Yard on the 28th ult. This destroyer is about 260 feet long and 26 feet 6 inches beam, and is fitted with Parsons' turbines and water-tube boilers burning oil fuel.—*Army and Navy Gazette.*

NEW DESTROYERS.—The Admiralty have placed orders for the construction of all the sixteen destroyers provided for under the present year's program, with the exception of the *Menace, Marskman* and *Monitor.* The *Manly, Minos* and *Miranda* will be built by Messrs. Yarrow & Co., of Scotstoun; the *Milne, Moorsom* and *Morris,* by Messrs. J. Brown & Co., of Clydebank; the *Mansfield* and *Mentor,* by Messrs. Hawthorn, Leslie & Co., Newcastle-on-Tyne; the *Mastiff* and *Meteor,* by Messrs. Thornycroft & Co., Southampton; the *Matchless,* by Messrs. Swan, Hunter & Wigham Richardson, of Newcastle-on-Tyne; and the *Murray* and *Myngs,* by Palmer's Shipbuilding Co., Jarrow-on-Tyne.—*United Service Gazette.*

H. M. S. "LAWFORD."—Torpedo-boat destroyer, for the British Admiralty under the 1912-13 naval program; 935 tons displacement. The propelling machinery consists of Parsons' turbines of 24,500 shaft horse-power, and were constructed by the shipbuilders. Launched, October 30.—*Shipbuilding.*

"LLEWELLYN."—Torpedo-boat destroyer, for the British Admiralty under the 1912-13 naval program; 935 tons displacement. The propelling machinery consists of Parsons' turbines of 24,500 shaft horse-power, and were constructed by the shipbuilders. Launched, October 30.—*Shipbuilding.*

Paragon (t. b. d.), was commissioned at Portsmouth, December 11, 1913, This is one of the last boats of the 1911-12 program (K class), and was not long since delivered by Messrs. Thornycroft. She will join the fourth destroyer flotilla.—*Navy and Military Gazette.*

Laertes (t. b. d.), originally known as the *Sarpedon,* has been commissioned for service in the new third destroyer flotilla, and has taken up her duties at Harwich. She is the first unit of the 1912-13 program to go into active service.—*Navy and Military Gazette.*

H. M. S. "LYSANDER."—This ocean-going torpedo-boat destroyer, built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at their Wallsend shipyard, has successfully completed a series of trials at sea. The trials which the *Lysander* has undergone include a twenty-four hours trial at cruising speed, an eight hours run at full power, running astern, testing the deck machinery, and torpedo-launching tubes, and also firing the guns under service conditions. She is now receiving her finishing touches and having the engines inspected, after which she will be made ready for acceptance by the Admiralty. The turbines and boilers have been built by the Wallsend Slipway & Engineering Co. The boilers are of the Yarrow water-tube type, and have oil-burning furnaces. It was found that they were able to easily maintain an ample supply of steam during all the trials. The turbines are of Parsons' impulse and reaction type, operating two propellers each on a separate shaft. Both the astern and the ahead turbines are enclosed in the same casing in each set. Steam is admitted through a series of nozzles, so arranged that a given number of them can be used according to the speed at which it is desired to drive the ship, and in this way the best economy of steam is obtained.—*Page's Engineering Weekly.*

Fortune (t. b. d.), on acceptance from the contractors about the 11th inst., is to be commissioned at Portsmouth for service in the fourth flotilla.—*Army and Navy Gazette.*

"GARLAND" (t. b. d.).—The torpedo-boat destroyer *Garland,* which has been built by Messrs. Cammell, Laird & Co., Birkenhead, from the designs of Parsons' Marine Turbine Company, carried out her official acceptance trials successfully and afterwards left for Chatham, to be commissioned with a full crew for service in the fourth destroyer flotilla. The vessel is one of the eight privately designed destroyers of the 1911-12 program, and draws two inches less water and has a displacement of 29 tons more (964 tons) than the twelve Admiralty designed destroyers of the *Acasta* class, while her speed is estimated at 30 knots as compared with the 29 knots of the latter class. The *Garland* and the other seven vessels of her class are armed with three 4-inch quick-firing guns, the *Acasta* type being armed with three 4-inch breech-loading guns. The *Garland* has a length of 260 feet, a breadth of 27 feet, and her turbines have been designed to indicate 24,500 horse-power.—*United Service Gazette.*

The *Leonidas,* launched from the Jarrow shipyard of Palmer's Shipbuilding & Iron Co., Ltd., is the first of two torpedo-boat destroyers, the

hulls of which Palmer's Company are building for Messrs. Parsons' Marine Steam Turbine Co., Ltd., who are the main contractors in H. M. Government for the vessels. In proposing success to H. M. S. *Leonidas*, Mr. Ritchie said the vessel was the first of two boats that Palmer's had been entrusted to build by the Parsons' Marine Steam Turbine Co. for the British Admiralty. The sister ship, *Lucifer*, was on the stocks, as they would have doubtless observed, and was nearly ready for launching. They were very pleased with the confidence that Messrs. Parsons had reposed in them, which was no doubt acquired by their long and successful experience in building this type of ship. The *Leonidas* was the twenty-ninth torpedo-boat destroyer Palmers had launched for the British Navy.—*Page's Engineering Weekly.*

A new order of the Admiralty decrees that captains as commanders of destroyer flotillas shall be embarked in a destroyer. During the grand maneuvers the cruisers did not accompany the flotillas, but were attached to the battleship squadrons, and the hope has not been fulfilled that at least the scout-cruisers were to be flagships of the flotillas. The commander of the fourth destroyer flotilla is embarked in the *Swift*. The other flotillas of the first fleet are to have seagoing destroyers of the tribal class as flagships. The reason for this measure evidently lies in the view that the flagship must have a speed at least equal to that of the flotilla, which has not been the case where scout-cruisers were used as flotilla flagships.

Submarine *E 8*, launched at Chatham dockyard, is a sister boat to *E 7* and her engines, which have been made in the yard, are estimated to develop a speed of 16 knots on the surface and 10 knots submerged. In addition to four torpedo tubes, the vessel will be armed with two 3-inch quick-firing guns.—*Page's Engineering Weekly.*

Two submarines of the *E* class have also been launched within the month, each with a surface tonnage of 700, indicating the rapid advance made in the size of these craft, which are credited with having created surprises in the recent North Sea maneuvers.—*Shipbuilding.*

"C 14" IN COLLISION.—Submarine *C 14*, one of the six boats of the third flotilla, which has its base at Devonport, was sunk between Drake's Island and Devil's Point in Plymouth Sound on December 10. The flotilla was returning from exercises in Torbay, and was passing through the Sound in line ahead. It met a line of dredger hoppers coming out of Devonport harbor, and the leading hopper came into collision with the submarine, with the result that the latter was holed so badly that she quickly sank. All the officers and crew were rescued.

The whole operation of locating the wreck, placing hawsers under her, lifting her and taking her into dock took about 30 hours. In the journey up the harbor the submarine was strung about 30 feet under a salvage lighter, especially designed for lifting submarines of the *C* class.

The *C* class of submarine is less than one-third the size of the much more seaworthy and efficient craft now being built, which displace over 1000 tons, and carry not only torpedoes of greater efficiency, as well as quick-firing guns on disappearing mountings, but represent many improvements in design, and possess higher speed and a greater radius of action. This is the first case on record in the British service of a submarine being lost without any sacrifice of human life. In every previous accident—whatever the cause—the service has had to mourn the death of several of the crew.

Woolwich, depot ship, Com. G. T. F. Pike, has been built for the purpose of a repair and store ship for a flotilla of destroyers, and has been fitted with machine shops and appliances. After having made her acceptance trials on the Clyde she proceeded to Portsmouth.—*Navy and Military Gazette.*

"TURMOIL."—The keel of the oil transport ship *Turmoil* was laid at Pembroke on November 4. The *Turmoil* is a sister ship of the *Trefoil* recently launched at Pembroke; her tank capacity is 2000 tons, she is to be equipped with internal combustion engines designed to give her a speed of 12 knots. England now possesses over 100 oil transport ships.

MINE SWEEPERS.—In addition to mine-laying vessels, the British Navy has a number of mine sweepers, built and equipped to sweep an enemy's mine field.—*Army and Navy News.*

"TREFOIL."—The fleet auxiliary *Trefoil*, the first internal combustion oil carrier built specially for the British Navy, was successfully launched at Pembroke Dockyard, October 27. The *Trefoil*, which is 300 feet long with 39 feet beam, has a draft of 18 feet, a displacement of 4000 tons, and an oil-carrying capacity of 2000 tons. The propelling machinery is being constructed at Barrow, and is of the internal combustion Diesel type, of 1500 horse-power. The ship was laid down January 15, 1913; she will be fitted with wireless telegraphy plant.—*Shipbuilding.*

BETTER TIMES FOR THE "SPOTTER."—Those officers of the fleet whose business it is to control the fire of the larger battleships and cruisers of the navy, are calling down blessings on the head of the designers of the *Iron Duke* and her younger sisters, who have at last set the foremost funnel back a decent distance from the fighting tops. Ever since the *Invincible* class was introduced the occupants of the fire-control platforms have been roasted and smoke-dried by the heat and smoke issuing from the foremost funnels of our large warships. Nor was this the worst, for the heat and ashes seriously interfered with directing the gun-fire of the ship, when the wind was anywhere abaft the beam, and the delicate instruments used for this work were often choked up with grime and rendered ineffective at a critical moment. An eruption of red hot clinkers is not good for either men or instruments, and the alteration of the position of the funnels of the *Iron Duke* is likely to assist in the accuracy of her gun-fire at long range, where so much depends upon the work performed on the control platforms. The *Lions* proved to be expensive in this matter, and the lesson may have led the designers to pay more attention to the point, so that in future the "spotters" may look forward to a cooler and cleaner time when performing their important functions aloft. The 6-inch battery in the *Iron Duke* is arranged in such a way as to give the ship a striking appearance; but the guns are so mounted as to give them an opportunity to do even more "striking" work in the hour of battle.—*United Service Gazette.*

STRENGTHENING AXIAL FIRE.—It is interesting to note the plan adopted for increasing the right-ahead fire of the *Queen Elizabeth.* In this vessel the 6-inch guns, well protected by armor, have been so arranged in echelon from the center line forward to the ship's side as to bring them to bear on a right-ahead target in a novel and unusual way. British designers had given up the echelon turret plan of mounting the main armament, after the completion of the first few dreadnoughts, and in adopting the middle-line plan had materially reduced the strength of their right-ahead and right-astern blow, in exchange for a very powerful fire developed on either broadside by the middle-line system. But no sooner do they return to the secondary battery in battleships that they have eschewed so long, than they use a portion of the secondary fire to increase their right-ahead blow. This shows that they gave up the echelon turret system with reluctance, and have taken the first opportunity to increase the axial fire forward. No doubt the crews of these guns would stand small chance against the fire of an enemy's main armament; but they could fight their guns against torpedo attack, etc., in seasonable weather, so far, at least, as the forward group is concerned. The plan of mounting the 6-inch guns is an ingenious and

clever one, and is fairly one to be copied by other nations who build ships with equal beam. The 15-inch and 6-inch forward guns in the *Queen Elizabeth* will not interfere with each other's fire by means of "blast," owing to the means taken to prevent this occurring. The success or failure of this plan of placing guns will be watched with interest by gunnery experts.—*United Service Gazette.*

FLEET MANEUVERS.—A few further details have been learned in regard to the maneuvers of the home fleet, which took place in the middle of October, under the chief command of Admiral Callaghan. To the home fleet were attached all available battleships and cruiser squadrons as well as eighty destroyers in four flotillas. All the exercises were conducted as nearly as possible under war conditions. Although the weather was very bad and heavy seas continued to pour over the decks, the destroyers remained at sea uninterruptedly for six days. Under these severe conditions they made numerous attacks on the battleships and cruisers by day and by night. Seven boats of the first destroyer flotilla, whose station was at Queensferry on the Firth of Forth, suffered serious damage from the heavy seas. Reserve ships, which were distributed along the coast, had to come to their assistance. Of the twenty destroyers of the first flotilla only thirteen were seaworthy at the close of the maneuvers.—*Ueberall.*

CAPITAL SHIP SIZE LIMIT.—Mr. A. E. Richards, assistant director of naval construction to the British Admiralty, is strongly of opinion that the growth of the capital ship has reached its limit, and that we shall soon witness a great reaction. There is good reason, in fact, to expect that the next batch of battleships to be laid down in Great Britain will be very much smaller than their immediate predecessors. We hear that one reason for this is the experience gained at the last naval maneuvers, one lesson of which had relation to the growing potency of the submarine. In actual war a large number of battleships would have been sunk by these craft. So now the opinion is developing that to reduce the size is to reduce the risk.—*Shipping,* Illustrated.

THE DREADNOUGHT POLICY.—Questions concerned with the design of our more recent warships are being raised again, and the arguments and assertions of those who oppose the dreadnought policy and principle are once more appearing in print. It might have been thought that these questions had been threshed out long ago, or at least that they had been answered when every first-class naval power accepted the principle involved and built ships to the all-big-gun, one-caliber design. High speed and heavy long-range guns, as the two primary elements of offence, are the distinguishing features of the dreadnought fleet, and the reasons why they are were ably explained by Rear Admiral Reginald H. S. Bacon, C.V.O., D.S.O., at a meeting of the Institute of Naval Architects in March last, on which occasion Mr. Alan Burgoyne's paper on "Recent Developments in Battleship Type" was read. In view of the renewed discussion about mixed armaments and more armor, we think our readers may like to have the admiral's speech reprinted:

"My Lords and Gentlemen:—I am sure we must all be very grateful to Mr. Burgoyne for having presented us with so able a paper on the points underlying the design of battleships. I may say I know of no summary more clear or more concise. At the same time we must be grateful to him for having exhibited some of those small red flags which are apt to arouse discussion. If I may, I would first like to deal with the few remarks made by Admiral Custance, because I should like to humbly take the other side of the question, and, I hope as shortly, but I fear not so ably or concisely, put to you the other point of view. Admiral Custance differed from Mr. Burgoyne as to whether we should destroy *matériel* or destroy gun-fire. The two are so intimately bound up that I do not think we need draw any hard

and fast distinction. If you damage the portion of the ship surrounding a turret, you damage the guns. If the decks are very badly injured you will probably not be able to fight the guns; therefore if you do destroy the *matériel* you probably also destroy the gun-fire. I think we might leave that there. But when we come to the best method of destroying gun-fire we come to the whole gist of the question as to whether we should use 6-inch guns or whether we should use the heaviest possible gun that can be put in a ship. I should like to draw your attention to some advice that was given many years ago by an old post captain to his aid-de-camp, who was a midshipman. He said: 'Boy, if ever you are dining, and after dinner over the wine some subject like politics is discussed, when men's passions are aroused, if a man throws a glass of wine in your face, do not throw a glass of wine in his; throw the decanter stopper'—and that is what we advocates of the heavy gun propose to do, not to slop the 6-inch shot over the shirt front of a battleship, but to go for her with the heaviest guns we can get; and the heavier the explosive charge you can get in your shell and the bigger explosion you can wreak on the structure near the turrets and the conning tower and over the armored deck, the more likely you are to disable that ship.

"We object—I speak humbly, as one of the multitude—most strongly to the fire of the big guns being interfered with by the use of smaller guns at the same time, with all the smoke and mess that are engendered by them. The attention of the observing officers is distracted, their sight is to a great extent obliterated, and even the theoretical result is not worth the candle. That is, to a certain extent, our side of the question. Now supposing that the 6-inch armament is no good in an action—I have no objection to its being there so long as it is not used, even at the beginning of the action it is useless—is there any use in protecting it by armor? Admiral Custance advocates that such an armament should have armor, but only armor sufficient to keep out the 6-inch shell, but not armor enough to keep out the heavy shells which are in reality going to kill the people at the light guns. In ships with only the heavy guns manned you have no men outside heavy armor; if you cannot perforate the armor you cannot hurt the men behind it. If your guns are behind the heavy armor, and you do not perforate the armor, unless you hit their muzzles you do not damage the guns, but there is no use for light armor which can be penetrated by heavy shell.

"We are, therefore, driven to these conclusions: If the light guns are to be used in action they must be protected by heavy armor; if they are not protected by heavy armor they will be useless at the end of an engagement; light armor is useless for their protection. Therefore the main use of a secondary armament, if for use in an action, is apparently to increase the necessity for armor in the ship.

"But if a light armament is no good for an action, is it any good against torpedo-boats? There, again, we think it is largely useless. The ordinary 6-inch gun in a battleship is, as regards torpedo-boat attack, of just as much use as a stick is to an old gentleman who is being snowballed; it keeps his enemy at a respectful distance but still within a vulnerable range. In these days torpedoes can be fired at ranges at which it is absolutely impossible even to hope or think of hitting the destroyer. You may try to do it, but it is quite useless. Very well, then, the 6-inch gun does keep the destroyer at a longer range than would be the case if the gun were not there, and that is the main use of the 6-inch gun as regards torpedo-boat attack. From this point of view only an unarmored 6-inch armament may possibly be justified. At least, that is what we conceive its justification to be, but personally, and I only speak for myself, I do think the better place for the 6-inch gun is in the auxiliary vessel that should form an integral part of the battleship unit.

"In the old days the battleship was the conception of a ship which nothing else on these waters could sink. But now the battleship is no longer

the ultimate power on the sea; it may be sunk by the smallest vessel afloat. Therefore it has lost its primary function, or one of its primary functions—namely, the ability in itself to defend oversea expeditions against anything afloat on the water. Now to make up for that inability she must have attendant torpedo craft which will keep the other torpedo craft at a respectful distance, so that the conception of the battleship now is no longer one unit enclosed in one hull, but is bound to come to a ship which has other adjunct vessels associated with her that will supply her with that portion of her power that she herself has lost.

"There is only one other point. I will not go into the question of heavy defensive armor, because I have taken up your time far too long already; but there is the problem of speed, which was touched on by Admiral Custance. I quite agree, from one point of view, that to lose two guns for an extra five knots speed seems a great loss; but there is one question which I should like to ask, and that is, whether you would send out to sea a whole fleet, the whole strength of the nation, with no one single ship of sufficient speed to pick up a particular ship of the enemy? That is the point to rivet your attention upon. We must always, in our navy, have some ships not of equal, but of superior speed to any one particular ship in the enemy's fleet, otherwise over the face of the sea you will have ships roaming about that nobody can overhaul and that nothing can touch. Many of you remember, no doubt, the time the two big Cunarders were subsidised. The sole reason for this was to possess two ships—truly of very inadequate armament—but still to possess two ships that had superior speed to certain ships of war that were actually existing in the navies of other countries. As long as we remain a fighting sea power, we must have not only ships of equal or superior armament, but we must at the same time—call them luxuries, call them what you like—we must, at any sacrifice, have ships that are able to overtake, fight, and sink the ships of any other country."—*The Army and Navy Gazette.*

Recruiting for the Royal Navy is very brisk, although trade is prosperous, and emigration is proceeding at a pace without parallel. The mere fact that the navy is securing so many youths up to the physical and mental standard adopted by the Admiralty is in itself evidence of the attraction of the sea service. Including the Royal Marines, the navy secured 13,000 recruits two years ago, and last year the number was about 18,000. Since the beginning of the present year, owing no doubt in part to the new promotion regulations and the increase of pay, recruiting has been brisker than ever. It has been possible to maintain the standard of height and chest measurement and yet obtain all the recruits needed. The physique of the new entrants compares favorably with those secured twenty years ago, when the aggregate personnel stood at only about 70,000; there need be no fear that they will not reach the total of 150,000 by March 21, 1915.—*United States Gazette.*

SPECIALIZING IN THE NAVY.—The Admiralty have issued a circular letter detailing the courses of training which officers who joined the navy under the common entry scheme of 1903 are to undergo when they specialize. There will be a preliminary course in the Royal Naval College, Greenwich, followed by a course of practical instruction at Keyham College. The course at the Navigation School for officers specializing as navigator has been extended to 99 days. A limited number of lieutenants (G.) and lieutenants (T.), first class, will be selected on the result of the practical course, and sent to the Royal Naval College, Greenwich, for an advanced course of six months. At the end of this an examination will be held as a test. All officers who take this course will be designated in the navy list "lieutenant (G.)" or "lieutenant (T.)" respectively. The preliminary courses at Greenwich will be—for gunnery, torpedo, and engineering, one course each year, opening on October 1 and lasting six months; for naviga-

tion, two courses each year, beginning on October 1 and April 1, and lasting three months, the practical course for gunnery and torpedo officers will be at Portsmouth. They are to begin at the middle of April, and will last eight months. For lieutenants (E.) there will be a twelve months practical course at the Royal Naval College, Keyham, beginning in the middle of April, and for lieutenants (N.) two courses each year at the Navigation School, beginning January and August respectively, and lasting 99 days. There will be advanced courses at Greenwich. Officers may volunteer to specialize in navigation and engineering when they have obtained their engineering and watch-keeping certificates, and in gunnery and torpedo at any time after attaining the rank of lieutenant. Officers selected to qualify as navigators must pass the Snellens sight test.—*United Service Gazette.*

NAVAL PROGRESS.—Replying for the navy at the Lord Mayor's banquet on November 10, the First Lord of the Admiralty said that next year there would be 150,000 sailors and marines in the regular professional service, which would exceed the largest numbers ever raised for the navy in the greatest crisis of the Napoleonic wars. It would be his duty to present estimates substantially greater than the sum originally voted in the present year. Referring to the submarine and air services, he said that the former, thanks to the foresight of Lord Fisher, was more than twice as powerful as that of the next strongest naval power; while "the British seaplane, although still in the empirical stage, like everything in this sphere of warlike operations, has reached a point of progress in advance of anything attained elsewhere."—*Journal of Royal Naval Service Institute.*

THE ROYAL AUSTRALIAN NAVY.—On relinquishing office as Minister of State for Defence, Senator the Hon. G. F. Pearce issued a memorandum, dated June 23, 1913, reviewing the progress made by the Defence Department in the three years which had elapsed since April 29, 1910. Under the heading of "naval defence," it is stated that on June 4, 1910, Admiral Sir Reginald Henderson was invited by cable to come to Australia to advise regarding a scheme for the naval defence of Australia. He accepted, arrived on September 7, and presented his report on March 1, 1911. In regard to ships, the destroyers *Parramatta* and *Yarra,* built in England, arrived in Melbourne in December, 1910, and the *Warrego* was launched at Cockatoo Island on April 4, 1911, and commissioned on June 1, 1912. The cruiser *Melbourne* arrived at Fremantle from England on March 10, 1913. The approaching arrival of the *Australia* and *Sydney* was also noted. Two submarines were said to be practically completed, and a parent ship for them had been ordered through the Admiralty to be built in Great Britain, as well as an oil supply ship. Oil storage vessels for harbor use are being built in Australia. The cruiser *Brisbane,* and destroyers *Swan, Derwent* and *Torrens,* are building in Australia. As regards other vessels, the cruiser *Encounter* was taken over by the commonwealth on July 1, 1912, to serve until the *Brisbane* is completed. The cruiser *Pioneer* was also taken over, on March 1, 1913, as a gift from the Admiralty. The *Protector* is being rearmed for use as a gunnery tender at Williamstown, and the *Gayundah* is also being rearmed for use as a training ship for the naval reserves. The Australian fleet at present constructed is thus as follows: *Australia,* battle-cruiser; *Melbourne, Sydney, Encounter* and *Pioneer,* cruisers; *Protector* and *Gayundah,* gunboats; *Warrego, Parramatta* and *Yarra,* destroyers; *Countess of Hopetoun* and *Childers,* torpedo-boats; and *A. E. 1* and *A. E. 2,* submarines. As regards personnel, the total in 1910 was 240, but the total on June 1, 1913, was 3400, of whom 1660 had been recruited in Australia. Recruiting and training accommodation were described, and the memorandum also dealt with administration, naval bases, wireless, naval reserves, naval expenditure, and the Royal Australian Naval College. Under the last-named heading, it was stated that entrance to the college is by competitive examination and medical test, and the college course is free. Rear Admiral Sir George E. Patey, in the *Australia,* with the *Sydney,* arrived at Albany,

Western Australia, on September 19, where he issued the following message to the press: "The Royal Australian Navy has come to stay. The scheme is sound and well thought out, and a good beginning has been made. We received a most complimentary welcome in South Africa, and have been much gratified by welcoming messages from Australia and New Zealand. We look forward to our work with the greatest enthusiasm."—*Journal Royal Naval Service Institute.*

The Australian station has ceased to be a British Admiralty command. The growth of the Australian local navy justifies this step. At the present time the third-class cruisers *Pyramus* and *Psyche* are the only British warships on the station, while the commonwealth fleet includes the battle-cruiser *Australia,* the four light cruisers *Brisbane, Melbourne, Sydney* and *Encounter,* averaging 5500 tons each, five smaller cruising ships, three powerful destroyers, and a submarine flotilla. Never before has there been anything approaching this force under the white ensign at the Antipodes.—*Shipping.*

THE COLONIES AND THE EMPIRE'S FLEET.—Those who are complaining so bitterly about the erratic policy of the governments of our self-governing colonies in respect to the naval question, as it affects the Empire as a whole, appear to wholly overlook the spirit of nationality that is bound, sooner or later to find expression in the words and acts of large communities growing into young and lusty nations. To try to suppress this spirit would be a mad act that might easily lose us a continent, just as the tea incident in Boston harbor cost us America, when she cut the painter and declared her independence. We must, therefore, willynilly, like what we can get if we cannot get what we would like in a matter of this sort. We can hardly expect that the colonies will see eye to eye with us on all the points of an Imperial naval policy, but the divergence is not so large, probably, but that a little give and take would lead to a practical working arrangement. In any case, we have to remember that to the extent that the colonists pay the piper they are eminently likely to want to call the tune.

What has proved, so far, to be the most disconcerting element in the arrangements that had been previously made with colonial statesmen is the way in which their successors in the seats of the mighty have thrown overboard, almost bag and baggage, all the engagements entered into, and have modified, or completely reversed, the programs laid down. If this unstable element is to remain, no arrangement made, either by conference or correspondence, can be worth the paper it is written on, and nothing but confusion and uncertainty can possibly prevail. The immense loss of money entailed on the colonies by such wavering and reversions is a matter for themselves, rather than for us; but they must necessarily entail a huge expenditure, with worthless results. Following the Borden and Laurier dispute in Canada, we now have the new Premier of the Dominion of New Zealand not entirely reversing, to be sure, but greatly modifying the program and policy of his predecessor. The Massy and Ward policies differ in important essentials. The latter was content to pay the mother country a substantial annual contribution and have the ships that New Zealand was paying for, largely manned by fleetmen drawn from the mother country. Mr. Massy contemplates, and is prepared to set up, a naval training establishment in New Zealand waters, and train Dominion recruits to man Dominion ships. The question of obtaining a sufficient number of volunteers has apparently been thought out and decided in the affirmative, although Australia, and especially Canada, have had considerable difficulty in this direction.

Then in respect both to the building and the control of the warships provided by Dominion money, the Massy and Ward policies are at variance; for, while Sir Joseph Ward arranged for the control of the vessels, both in peace and war, to be under the Admiralty, Mr. Massy would have them under the control of the Dominion Government in time of peace, passing automatically to the Admiralty in time of war. Mr. Massy also purposes

tethering the Dominion vessels to the coasts of New Zealand in time of peace, while Sir Joseph Ward's government arranged, first for their battle-cruiser to be used as a flagship for a Pacific fleet which it was then agreed should be brought into being, and subsequently permitting it to be used in home waters, after a visit to the ports of the Dominion who paid for her. The battle-cruiser *New Zealand* is now on her way to England from this cruise, and will shortly join the home fleet. Whether it is the intention of Mr. Massy's government to ask for the return of this fine vessel to the Dominion waters, for it to remain there while peace lasts, the Premier of New Zealand has not yet indicated.

However this may be, the change of policy and arrangements is unsettling, and no doubt causes anxiety at Whitehall, for, although there is no help for it, the fact that this wobbling may be a factor of the future must seriously handicap the authorities here in making out their programs and shaping their strategy to meet all emergencies with which the Empire as a whole may be faced. It is no doubt true, as Mr. Massy says, that the British Dominions in the Pacific must aim at nothing less than the same naval supremacy in those seas that we hold in the near seas on this side of the Empire. But to that end we can only make haste slowly, unless the colonies with seaboards on the Pacific are prepared to spend freely to gain the required supremacy in their own waters. The way they will do this rests with themselves, but the mother country, who has so long paid the piper and kept the peace in the Pacific and other seas, while these young nations have been growing into manhood, may be permitted the word of advice that they should agree among themselves what they really intend to do, and then lose no time in carrying out their policy, for while the grass is growing the horse is starving. A change of government has caused a loss of two, and it may easily be four, years in carrying out the intentions of Canada to help the Empire fleet, in one way or another. This, to say the least, is a little disconcerting and disappointing at a moment when the authorities of the mother country, pressed by serious rivals on all sides, are pouring out money like water to safeguard the interests on the sea of the whole Empire. By all means give the national spirit in the colonies all the expression it desires and deserves; but the groaning taxpayer in the mother country may well say to our colonial cousins—do, please, settle your differences, and act promptly.—*United Service Gazette.*

THE POSSESSION OF THE ÆGEAN ISLANDS.—This is, of all territorial disputes in the Near East, the most vital to England. We have clearly announced that we cannot allow these islands to be annexed by any of the great powers, and, so far, our government has obtained the support of the concert in the matter. Italy still retains some of the islands, but nearly all are held by Greece. Obviously we cannot afford to allow Italy to create island bases near the mouth of the Suez Canal and the coast of Egypt. Here, then, is a possible cause of war unless the powers continue to act in harmony. It may be argued that it matters little to us whether the islands are held by Greece or Turkey, but it is imperative that the decision of the concert shall prevail, otherwise there can be no permanent settlement in the Balkans. The chances are that the Ægean question will be settled on paper some time before the two Turkish dreadnoughts are ready for service. It remains to be seen if Turkey will submit to the concert, or if she will defy its decision, as she did with complete success in the matter of Adrianople.—*Naval and Military Record.*

ENGLAND'S NAVAL SUPERIORITY.—It is quite true, as *The Daily Chronicle* has urged, that strong expressions of opinion in support of the reduction or limitation of armaments have been made from time to time by both Mr. Asquith and Mr. Churchill; but where the Chancellor of the Exchequer "broke adrift" was in urging that a "real effort" should be made "to reduce the overwhelming extravagance of our expenditure on

armaments." It is therefore Mr. Lloyd George's presumably honest belief that our naval expenditure, and our naval strength resulting from it, is "overwhelmingly extravagant," and if that opinion is indeed held honestly we cannot avoid the conclusion that it has been arrived at without the least effort having been made to examine the facts. Does Mr. Lloyd George disagree with Mr. Churchill's declaration that a superiority of 50 per cent over Germany is necessary as regards fully commissioned dreadnoughts in home waters? He has not expressed himself to such effect, at any rate, and if he agrees that it is a reasonable and necessary standard his attention may be invited to the fact that we have now 21 fully commissioned dreadnoughts in home waters to Germany's 16, and a total of 29 battleships and battle-cruisers to Germany's 24. These figures disclose not an extravagance, but a failure to maintain a standard deliberately described as the "minimum consistent with full security." It is just possible—but exceedingly unlikely—that Mr. Lloyd George has based his conclusions on completed strength, without regard to ships in commission or in reserve; but here we find that in place of having a superiority of 60 per cent in completed ships our dreadnought margin (apart from Dominion ships) is only 25 vessels to 17, or 47 per cent. Even the proposed program of four ships next financial year will give us only 43 dreadnoughts against Germany's 28, which gives a margin of only 53.6 per cent. There is, in fact, not the slightest ground for the assertion that our naval superiority over the next power is "overwhelmingly extravagant"; rather it is not up to the standard which, in the opinion of the majority of people who have given serious thought to the matter, is itself inadequate.—*Naval and Military Record.*

RELATIVE NAVAL STRENGTH.—"We are all relatively where we were," declares the Chancellor of the Exchequer. If this were true it would provide ample justification for the growth of British Navy estimates, since the most we desire to do is to maintain our position. It is, however, very far indeed from the truth. Take the position as it stood ten years ago. At that time, according to an official return corrected to March 31, 1904, the eight principal naval powers (including Austria, which power was not then included in the return) possessed between them 82 completed battleships that had not been launched more than ten years, and of these Great Britain owned 30, or 36.59 per cent, while Germany's share was 10, or 12.2 per cent. It will be noticed that we had exactly three ships to each one of Germany's. What is the position to-day? These same eight powers now possess 99 battleships not over ten years launched, and Great Britain (in spite of the increase of 17 in the total) has only 24, or 24.24 per cent, while Germany has increased her share to 19, or 19.19 per cent. Is this what Mr. Lloyd George means when he says that "we are relatively exactly where we were"?—*Naval and Military Record.*

OPPORTUNITIES ATTENDING SEA LIFE.—There are hundreds of ladies and gentlemen engaged in philanthropic work in this country who greatly assist, directly or indirectly, in naval recruiting and this no doubt accounts for the large number of boys who are always on offer to be trained for sea life, either in the Royal Navy or Mercantile Marine. The cry is ever for British seamen for British ships in the merchant service, and it is as important to man our merchantmen with the best class of men, as it is to place keen, intelligent men behind and around the guns of our warships. There has, happily, been a much better outlook for men who follow a sea life, both in the Royal Navy and the Mercantile Marine, during the last few years, and it is satisfactory to know that these conditions are still improving. An active, intelligent, energetic lad can look forward to getting ward-room rank in the navy fairly easily in these times, as is proved by the fact that over fifty men who entered at the hawse-pipe have, during the last year, been promoted at a comparatively early age for a course of instruction which will, if they are successful, start them out for commander rank with

the certainty of reaching that goal; while it may happen that one or more of them may reach the higher position of captain and even flag rank. Such a career is as good as any that the country can offer to the sons of the poorer classes, and in the merchant service men frequently climb from boy to captain, and earn a competence on which they can retire at an age at which they would be pensionable in the senior service.—*United Service Gazette.*

Changes and developments in the British Navy during the year 1913 are summarized in the *Marine Rundschau,* January, 1914, as follows:

1. Increase of sea strength in out-lying waters; especially in the Mediterranean by the addition of four *Invincibles* and by the substitution of modern vessels in place of older ones; and by stationing the fourth cruiser squadron in the Bermudas.
2. Plan for the formation of an "Imperial Squadron" with Gibraltar as a base.
3. Strengthening of the second and third fleets. (Squadron V now consists of 8 line-of-battle ships (Linienschiffe); Squadron VI of 5, Squadron VII of 8, and Squadron VIII of 6.)
4. Classification of cruisers as "battle-cruisers," "cruisers" and "small cruisers."
5. Formation of two new squadrons of small cruisers.
6. The training school squadron to consist of 8 ships with base at Queenstown.
7. Creation of a Department of Aeronautics.
8. Plan for six airship bases on the Channel and North Sea.
9. Discontinuance of the grade of supplementary lieutenants; immediate admission of students in higher schools to the course of training for naval officers; selection of petty and deck officers for promotion to the rank of officers, to supply the present need of more younger officers.
10. Measures for improving the status of enlisted men and employees in navy yards.
11. Armament of merchant steamships.

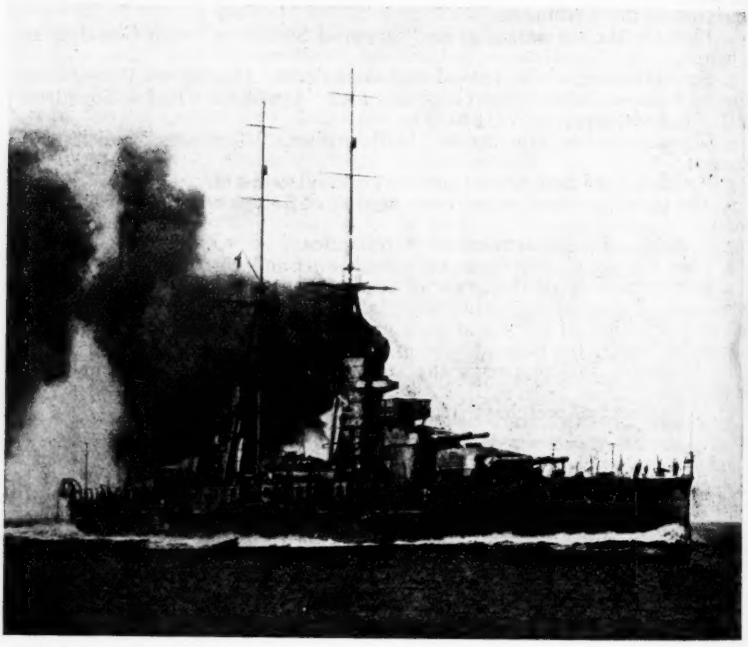
ITALY

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Cavour	22,000	22	13 12-in., 18 4.7-in.	Spezia	Launched Aug. 10, 1911
Giulio Cesare	22,000	22	same	Ansaldo-Armstrong	Undergoing trials
Leonardo da Vinci	22,000	22	same	Genoa (Odero)	Launched Oct. 14, 1911
Andrea Doria	22,400	23	13 12-in., 16 6-in.	Spezia	Launched March 30, 1913
Duilio	22,400	23	same	Castellamare	" April 24, 1913
Dandolo	28,000	25	8 15-in., 16 6-in.	Ansaldo	
Morosini	28,000	25	same	Odero	
Guiseppe Mazzini	28,000	25	8 15-in., 20 6.in.	Spezia	
Goffredo Mameli	28,000	25	same	Castellamare	

THE ITALIAN BATTLESHIP "GIULIO CESARE."—The Italian battleship *Giulio Cesare* recently underwent her final speed trials, and during the eighteen hours' test at four-fifths speed the engines developed 19,000 horse-power instead of the 16,000 horse-power specified in the contract, and drove the vessel at nineteen knots. The engines were then put to full speed for six

hours more and developed over 30,000 horse-power, in place of the 24,000 horse-power contracted for, giving a speed of 22.5 knots and surpassing by half a knot the figure of the estimates. We reproduce herewith a photograph of the *Giulio Cesare* taken during the trials and obtained through the courtesy of the builders, Messrs. Gio. Ansaldo & Co., Sestri Ponente. The *Giulio Cesare* is one of a group of three ships laid down in 1910, her companions being the *Conte di Cavour* and *Leonardo da Vinci*. The main dimensions of these ships are: Length on water line, 551 feet 5 inches; breadth, 88 feet 6 inches; mean draft, 27 feet 2 inches; displacement, 22,340 tons. The main armament is composed of a battery of thirteen 12-inch 46-caliber guns, mounted in center line in five turrets, the lower end turrets



THE ITALIAN BATTLESHIP "GIULIO CESARE" STEAMING AT 22½ KNOTS ON TRIAL

having three guns each, with two 2-gun turrets firing over them. One 2-gun turret is located amidships between the two funnels and has no end-on fire. The secondary battery consists of eighteen 4.7-inch 50-caliber guns. There are also fourteen 3-inch guns and three 18-inch torpedo tubes submerged, broadside and stern. The armor defence is composed of a complete belt of Terni steel 9.8 inches thick amidships, tapering to 5.9 inches forward and 4.7 inches aft. On normal draft, this armor belt reaches about 5 feet below the water line. There is also 8.7-inch armor on main deck side amidships, 9.4-inch armor on turrets, 9.1-inch armor on barbettes, 5.9-inch steel on battery, 11-inch armor on conning tower and 2-inch plating on deck sloping. The normal bunker capacity is 984 tons, rising up to 2460 tons. The propelling machinery consists of Parsons' turbines driving four screws and supplied with steam by twenty Blechynden water-tube boilers, fitted to burn coal and oil and located in ten water-tight stokeholds. There

are six turbines for ahead steaming and four for going astern. The total designed horse-power of the turbines was 24,000, of which 14,500 was for the astern turbines. The total grate area of the boilers is 1765 square feet, and the total heating surface 96,000 square feet. There are three condensers with a cooling surface of 19,200 square feet, each of which is fitted with two circulating pumps. There are provided also two evaporators, of 100 tons daily capacity, for use as boiler feed water and two fresh water distillers, of a daily capacity of 90 tons, for the use of the screw, besides three refrigerating machines for cooling the ammunition magazines and ship's stores. Their daily capacity is 2645 pounds of ice. Two electrically-driven centrifugal pumps of a capacity of 600 tons and two steam pumps with a capacity of 200 tons are provided for use against any inrush of water, besides being fitted to act as auxiliary to the condenser pumps. Electric power is generated by six turbine-driven dynamos of 150 k.w. capacity each and divided into three independent stations. For the operation of the turrets both electric and hydraulic power has been provided. Both hull and machinery were built entirely by Messrs. Gio. Ansaldo & Co., while the armor, guns and mountings were supplied by the Vickers-Terni Co., Spezia.—*Shipping*, Illustrated.

NEW BATTLESHIPS.—Work is to begin early in 1914 upon the first vessels of a new class of battleship, designed by Major General Ferrati. It seems evident that this must be the *Dandolo* class, of which the *Dandolo* and *Morosini* were understood to have been laid down at the end of 1912. The delay may no doubt be explained by a lack of financial provision, and to the necessity of installing new plant in the ordnance factories to manufacture the larger guns required by the ships. The *Mazzini* and *Mameli* will complete the class. Considerable divergency of opinion regarding their design has been revealed during the year, and it was stated in November that no definite settlement had been made. The details published in the Italian press, however, showed that the vessels would have a displacement of 30,000 tons, a length of 692 feet, a main armament of eight 15-inch guns, a speed of 24 knots, and a complement of 1300 officers and men. It was said that they would take between four and five years to build, and would cost £3,400,000 each.—*Journal Royal Naval Service Institute.*

"NINO BIXIO" CLASS.—There is much adverse comment in regard to the cruisers of the *Nino Bixio* class; it is said that they are overloaded, have small stability, and roll heavily in a very moderate sea; it is also reported that at high speeds the vibration is excessive. In how far the criticisms of the press are sustained by the facts is not known, but it seems certain that the ships of this class are to be rebuilt, which will delay their equipment for at least three months. If the reported change from oil-burning to coal-burning boiler equipment takes place, it will be interesting to note as being a case where the use of coal instead of oil is expected to produce better results.

"QUARTO."—The Italian cruiser *Quarto*, the nameship of a class of three light cruisers, has recently been completed for the Italian Navy. These vessels are 432 feet long and have a displacement of 3300 tons. The propelling machinery indicates 25,500 horse-power and gives a speed of 29 knots. The armament consists of six 4.7-inch quick-firing guns and six 12-pounders. An improved class is being armed with 6-inch guns.—*Shipbuilding.*

SUBMARINES.—In regard to the new submarines the following particulars are known: Italy has four types of these boats, some of which are completed and some of which are still building. There are eight boats of the *Zoea* type launched at the Fiat yard in Spezia in 1912-13. Their displacement submerged is 300 tons; speed on surface 14 knots and submerged 8 knots;

600 horse-power; 2 torpedo tubes. The second type comprises the *Giacinto Pullino* and *Ferraris*, also built by the Fiat Company; displacement 394 tons; 1200 horse-power. The third type includes the *Nautilus* and *Nereide*, built in Venice; displacement 221 tons; 600 horse-power. The fourth type is the *Atropo*, launched in March, 1913, from the Germania yard at Kiel; displacement, submerged, 320 tons; surface speed 12.5 knots; two Diesel engines, each of 350 horse-power; steaming radius 1300 miles; submerged propulsion by means of two electric motors of 400 horse-power combined. Upon the completion of these boats Italy will have over 20 submarines.

THE FLEET.—As soon as the *Guilio Cesare, Leonardo da Vinci, Nino Bixio* and *Marsala* are placed in service the Italian fleet will be organized as follows:

First Squadron

Commander-in-Chief and Commander of the First Squadron: Vice Admiral Amero d'Aste.

First Division	Second Division
Dante Alighieri (flagship).	*Guiseppe Garibaldi* (flagship).
Guilio Cesare.	*Varese.*
Leonardo da Vinci.	*F. Feruccio.*
Nino Bixio (scout)?	*Coatit* (scout)?
4 destroyers (*Audace* class).	*Agordat* (scout)?
	4 destroyers (*Lauciere* class).

Third Division (Training Ships)

Benedetto Brin (flagship and gunnery training ship).
Regina Margherita.
San Marco (gunnery training ship).
Carlo Alberto, Liguria, Miseno, Palinuro (training ships for apprentices).

Second Squadron

Commander of the Second Squadron: Vice Admiral the Duke of the Abruzzi.

First Division	Second Division
Regina Elena (flagship).	*Pisa* (flagship).
Vittorio Emanuele.	*Amalfi.*
Napoli.	*San Giorgio.*
Roma.	*Marsala.*
Quarto.	4 destroyers (*Carabiniere* class).
4 destroyers (*Indomito* class).	

The *Re Umberto, Sicilia* and *Sardegna*, until now in the training ship division, will be placed out of commission; the *Dandolo, Italia* and *Lepanto* will be employed in harbor defence. There are, built or building, the following ships which replace those named above: *Dante Alighieri, Leonardo da Vinci, Guilio Cesare, Conte di Cavour, Caio Duilio* and *Andrea Doria;* of the three last only the first will be ready for a long time. The torpedo-boat *37 P. N.*, built by the firm of Pattison in Naples and the last but one of 18 built by that firm, was launched with steam up and undertook at once a run to Castellamare di Stabia at a speed of 18 to 20 knots, returning to the arsenal at Naples.

INCREASE OF 3000 IN THE PERSONNEL.—There is a somewhat unusual feature in the navy estimates for the year 1914-15, since, in addition to the amount of 257,420,000 lire which is put aside for naval purposes, the government will demand authorization to draw upon 1915-16 budget in advance for a sum not exceeding 30,000,000 lire.

In view of the increase in the number of warships, it is proposed to raise the strength of the personnel of the navy from 35,000 to 38,000 men, at a cost of 1,982,000 lire. The item for the construction of new ships and the upkeep of existing vessels is 10,000,000 lire in excess of the amount required last year, and it is intended to add to it annually until it reaches in 1917-18 a total of 120,000,000 lire, at which level it will be maintained in succeeding years. The extraordinary credit will allow increases of 30,000,000 lire in the years 1918-19 and 1919-20.—*Naval and Military Record.*

THE CHIEF OF THE NAVAL GENERAL STAFF.—The province of the chief of the naval general staff includes everything that pertains to the readiness of the fleet for war and the mobilization of the naval forces. To him is assigned the duty, in affairs where there are joint operations of the army and the navy, of designating and creating fleet bases and supply depots, and particularly to take up the complex questions of coast defence directly with the chief of the army general staff. In addition he is to work out, according to instructions received from the Minister of Marine, the programs for exercises and maneuvers and he may, if he considers it advisable, undertake their supervision.

In other respects his functions are of an advisory nature and without executive power. He is expected to devote attention to the composition of the personnel and their organization, training, and employment at sea and on shore; and his opinions are to have great weight in the appointment of captains of ships and of commanders of the fleet and its subdivisions.

He is also to concern himself with the composition of the forces afloat, the drawing-up of building programs, and the specifications for new ships. As these last-named functions are partly the province of special commissions which are advisory to the Minister of Marine, any possible difficulties in regard to recommendations have been overcome by giving the chief of the naval general staff a seat and a voice in all such boards. Finally he is to be a member of the board of promotions. The foregoing clearly shows that the incumbent of the office of chief of the naval general staff is vested with an enormous influence on the conduct of affairs in the Italian Navy. The present incumbent is Vice Admiral Thaon de Revel.

By a royal decree of August 29, 1913, there was created in the naval general staff a division of naval history, whose function it is to prepare historical studies which in any way affect the navy. The chief of division is to be an officer of either the active or reserve list, named by the Minister of Marine upon recommendation of the chief of the naval general staff and of the "consiglio superiore di marina." The valuable naval journal *Rivista Marittima* will in the future be issued directly by the naval general staff.

THE STRANDING OF THE "SAN GIORGIO."—The cause or causes of the accident which has again overtaken the Italian armored cruiser *San Giorgio* must remain a mystery till the court-martial has pronounced its verdict. The authorities on board prevent all contact with the outer world, and have further debarred, by means of a cordon on land and patrol boats on the water, any approach to the stranded vessel—a measure, this, which has produced a deep-felt, and perhaps unreasonable, sense of irritation on the part of the Italian press, and has given rise to the wildest nautical theories which ever broke loose from a landsman's brain. Putting these aside, the bare facts which preceded the disaster may be impartially reconstructed as follows:

The *San Giorgio* had made a brief stay at Reggio Calabria, where she had been sent in an official capacity for the opening of the headquarters of the Red Cross Society in that town. She weighed anchor for Naples at six o'clock on the evening of November 21, with calm sea and no fog, and, within an hour, ran up for a considerable part of her length on the beach at Santa Agata, six miles north of Messina—see sketch map,

Fig. 1—and in an oblique direction to the shore. From this latter she now lies about 30 yards distant, with a slight list to starboard and canted up by the head about 7 feet above the normal water line. Her position somewhat suggests that of a ship ready for launching, and will be clearly seen from the photograph—reproduced in Fig. 2—for which I am indebted to the courtesy of the *Secolo*, of Milan. Some fishermen, engaged in their craft, saw the great mass coming head on to them, and waved their lanterns and shouted. The next moment the vessel was observed to swing around at an angle reckoned to have been about 35 degrees, and it is said that the helm

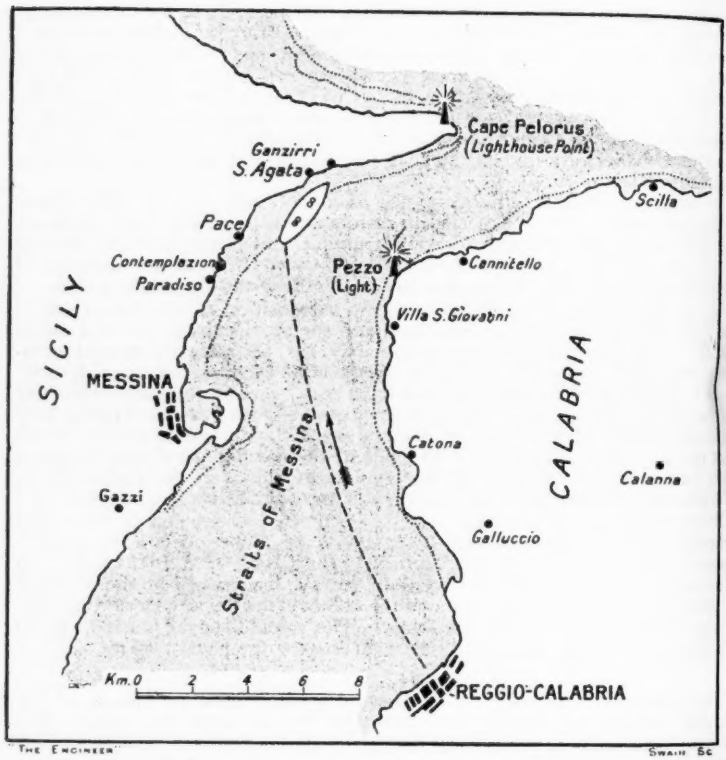


FIG. 1—STRANDING OF THE "SAN GIORGIO"—SITE OF THE ACCIDENT

was in that instant put hard over, and that the order was given to go astern with the starboard engines while continuing to go ahead with those on the port side. The maneuver was, however, performed too late, and its only effect was to make the ship take the ground obliquely instead of striking it head on.

An attempt was immediately made by the *Roma*, a large trader which came up by chance within a few minutes, to tow the vessel off, but the hawsers broke, and that first hope was abandoned. It was then decided to lighten the warship, and this proceeding has been going on day and night ever since. The operations, which will probably have to be of a radical nature, are facilitated by the presence of the *Ferruccio, Emanuele Filiberto,*

Vettor Pisano, and *Vulcano*, besides salvage vessels and a gang of 250 Castellamare dockyard hands, chosen from those who had already assisted the ill-fated cruiser when stranded on the Gaiola rock. The coal and ammunition were discharged at once; the 10-inch guns and the 7½-inch guns, together with the bow turret, have been, or are being, disembarked.

The bottom on which the *San Giorgio* rests is of sand and gravel with small protruding seaweed covered hummocks of rock, locally called *marmorini*, of a conglomerate nature, and of extreme hardness. Over these the vessel was driven at a speed of probably 16 knots, and in her passage she has bruised the plating of her bottom and torn it in various places. The leaks so formed are said not to be of a serious character; the largest of them is a zig-zag opening, about 15 feet long and 1 foot wide at its broadest part. In all likelihood, this hole is responsible for the partial flooding of the fore boiler-rooms, of the part which underlies the bow torpedo department, of the fore ammunition rooms attached to the 10-inch and 3-inch guns, and of some of the adjacent compartments of the double

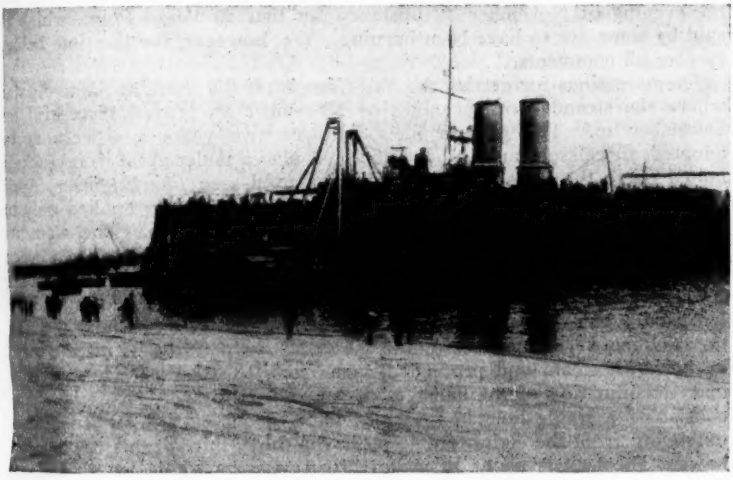


FIG. 2—THE "SAN GIORGIO" AGROUND

bottom. These are being pumped out, while the holes are being stopped with wood and cement, and the hummocks of rock blasted with small charges. Every form of salvage apparatus has been called to the rescue and is now on the spot. The *San Giorgio* is, according to the laconic official account, in a less dangerous position than she was in August, 1911. Her stranding on that occasion and the successful salvage operations, which will long remain memorable in the annals of naval engineering, were fully dealt with in *The Engineer* of August 25, 1911, and of April 19, and 26, 1912. It is therefore enough to say that on the Gaiola the vessel was suspended on her midship section on a point of rock, with her hull badly lacerated, and with deep water at her two extremities. She was, besides, exposed to the danger of the heavy seas that beat on Posillipo. In her present position she is cradled in the berth which she has dug for herself, and is less liable to injury from bad weather, even if coming from the southeast, to which quarter she is exposed. Besides this, her hull is much less damaged than it was by her first misadventure, and it is stated that not more than 1500 tons of water have leaked in instead of considerably over 4000 tons. On the other hand, there is great difficulty in blasting away the hummocks

of rock on account of their position and consistency; it will also be no easy matter to make use of the large compressed air caissons used on the former occasion for lifting her, having regard to the shallow water in which she lies.

The operations are under the direction of Admiral Cagni, commander of the Duke of Abruzzi's Polar Expedition, he being on board at the time of the accident, since the *San Giorgio* is the flagship of the protected cruiser division of the second squadron. The gallant admiral was, by a strange coincidence, the very officer who defended Comandante Albenga before the court-martial which sat on the last occasion. To accuse him of lack of seamanship would be simply puerile. To proceed with the list of superior officers on board, Comandante Cacace, the captain of the *San Giorgio,* is famous as being one of the ablest navigators in the Italian Navy; the lieutenant who was navigating is also extremely well thought of. Yet there can be little doubt that the Cape Pelorus light on the Sicilian coast was, on the evening of November 21, mistaken for that on Pezzo Point, which is said by some not to have been burning. We, however, for the time being, reserve all comments.

The operations for getting the *San Giorgio* off the shore at Santa Agata, where she stranded on the night of November 21, proved successful on December 10. The general lines followed two years ago were again adopted, air caissons and wooden pontoons placed under great iron brackets bolted on to the sides of the vessel being used—see *The Engineer,* April 19 and 26, 1912. This time, however, they were naturally applied only to the forward part instead of being fixed stem and stern. The elements proved allies as on the last occasion. On the night of December 9, when the preparations were almost ready, a gale from the northeast raised a sea which imparted an undulating motion to the vessel and seems to have loosened her in the bed which she had dug for herself. The next morning the caissons were pumped out, and the vessel warped herself off the beach by her own steam and proceeded, unassisted, to Messina, where a summary examination of the damage was immediately made. This is said to consist of a single hole in the third plate, about 92 feet in length, and extending from the eighth frame up to the thirty-third frame towards the bows. The leak is about 18 inches broad over its whole length and can be easily stopped sufficiently by the divers to render the ship watertight during her journey to Taranto dockyard, where she will now proceed for definite repairs. According to the opinion of a well-known Italian naval engineer, these will take about two months, after which time the *San Giorgio* will be able to return to her place without having in any way suffered in efficiency from her eighteen days' imprisonment.

The salvage operations were conducted by Admiral Cagni and Comandante Cacace, of the *San Giorgio,* in conjunction with General Ferrati, who has lately been appointed to the head post among the naval engineers left vacant by the retirement of General Valsecchi. By an order of the Minister of Marine dated December 11, Admiral Cagni and Comandante Cacace have been temporarily placed on the reserve list, while the navigating officer and the officer on watch at the time of the accident are under arrest pending the verdict of the court-martial.—*The Engineer.*

JAPAN

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Fuso	30,000	22.5	10 14-in., 16 6-in.	Kure	Laid down March 11, 1912
Fuso 2d	30,000	22.5	....	Kawasaki	" " May, 1913
Fuso 3d	30,000	22.5	....	Mitsubishi	same
Fuso 4th	30,000	22.5	....	Yokosuka	same
Battle-Cruisers					
Hiyei	27,500	27	8 14-in., 16 6-in., 8 t. t.	Yokosuka	Launched Nov. 21, 1912
Haruna	27,500	27	same	Nagasaki	" Dec. 14, 1913
Kirishima	27,500	27	same	Kobe	" Dec. 1, 1913

NEW BATTLESHIPS.—A Reuter telegram from Tokio on November 20 announced the beginning at Yokosuka of the fourth battleship of the *Fuso* class, and it was stated that the new vessel will have a displacement of 30,600 tons. With the laying down of this ship Japan has 12 dreadnoughts built and building; four battleships of the *Satsuma* and *Kawachi* types are completed, as is the battle-cruiser *Kongo*, which arrived in Japan on November 5; three sister ships to the *Kongo* are in hand. Lastly, there is the class of four super-dreadnoughts, to which the new ship *Yokosuka* belongs. These latter vessels have been designed for 22 knots speed. Their armament has been given by some accounts as twelve 14-inch, and by others as ten 15-inch guns. They will also carry sixteen 6-inch guns.

"FUSO."—The construction of the battleship *Fuso* has been subjected to such delays that instead of being launched in December, 1913, she will probably not be launched until February, 1914. In the meantime the installation of the propelling machinery furnished by Vickers—45,000 horse-power Parsons' turbines, 4 shafts, and the armament, twelve 36.5-cm. and sixteen 15.2-cm.—is being proceeded with. It is expected that the next three ships to be laid down will be sister ships of the *Fuso*.

"KIRISHIMA" AND "HARUNA."—The Japanese battle-cruisers *Kirishima* and *Haruna* were launched respectively at Nagasaki on the 1st, and Kobe on the 14th of December. They are sister ships to the *Kongo*, in commission, and to the *Hiyei*, launched November 19, 1912, and are the last of this group to go afloat. They are 704 feet long over all, with a beam of 92 feet and a displacement of 27,500 tons. The designed horse-power is 68,000, the *Haruna* having Curtiss and the others Parsons' turbines, 27 knots being the contract speed. The principal belt has a maximum thickness of 10 inches, and the armament consists of eight 14-inch, sixteen 6-inch, and sixteen 14-pounder guns, and eight 21-inch submerged torpedo tubes.

SUBMARINE LAUNCHED.—A submarine of the *Lauboeuf* type was launched for Japan at Chalvus-sur-Saone, France, November 11.

JAPAN'S NAVAL BUDGET.—Rear Admiral Saito demands through the press the increase of the naval budget from 95 to at least 136 millions of marks annually. He calls attention to the fact that before the Russo-Japanese War, Japan's fleet was exceeded only by those of England, France and

Russia, whereas now Japan is in fifth place and must fall even farther behind other sea powers if but one ship is laid down each year. Therefore the strategic position of Japan is becoming more and more unfavorable, and the completion of the Panama Canal will aggravate the situation.—*Marine Rundschau.*

NORWAY

The names of the two Norwegian coast defence battleships now under construction at Elswick are to be *Bjorgvin* and *Nidaros.* The vessels will displace about 5000 tons. The length is about 308 feet by 56 feet beam. The speed is to be 15 knots. Some originality marks the design as far as the arrangement of armament is concerned. This consists of two 9.2-inch guns in single turrets forward and aft, and four 6-inch, which are mounted in pairs in center line turrets firing over the single 9.2-inch turrets. There will also be three 4-inch weapons on each broadside. These two ships will form the third pair of Norwegian coast defence vessels constructed by Sir W. G. Armstrong, Whitworth & Co., Limited, and reflect in their small way the growth in size, power and arrangement that has been simultaneously taking place in larger vessels. The previous pairs were the *Haafagre* and *Tordenskjold,* built in 1897, and the *Norge* and *Eidsvold,* in 1901.—*The Engineer.*

PORTUGAL

It is stated that the Portuguese Government has definitely decided upon the construction of three battleships having a displacement of 22,000 tons, a speed of 22 knots, and an armament consisting of an unstated number of 13.5-inch guns. The vessels will be built in England by a British syndicate.

ROUMANIA

The four destroyers being built by Pattison in Naples are to be of 1400 tons displacement; 95 meters long, 9.5-meter beam, draft 3 meters. The armament is to consist of three 12-cm., seven 7.6-cm. rapid firing guns, and two torpedo tubes. They will have Tosi turbines and a speed of 35 knots is hoped for.—*Mitt. aus dem Geb. des Seew.*

INCREASE OF NAVAL POWER.—The Roumanian Government is intending considerably to increase its status as a naval power, which has never so far been very great, its present most powerful vessel being the protected cruiser *Elisabeta,* built at Elswick in 1897. Nevertheless a program covering several years and involving no less a sum than £6,000,000 has been approved. Four torpedo-boat destroyers of 1500 tons, 35,000 horse-power, and 35 knots, have already been ordered from Messrs. Pattison at Naples, and orders for four 600-ton monitors for the Danube service, six coast defence cruisers of 3500 tons each, and twelve torpedo-boats are expected to be placed at an early date.—*The Engineer.*

RUSSIA

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Sevastopol	23,300	23	12 12-in., 16 4.7-in.	Baltic Works	Launched June 29, 1911
Petropavlovsk	23,300	23	same	" "	" Sept. 9, 1911
Poltava	23,300	23	same	New Admiralty	" July 10, 1911
Gangut	23,300	23	same	" "	" Oct. 7, 1911
Emperor Alexander III	21,000	21	12 12-in., 20 4.7-in.	Nikolaieff	" July 24, 1912
Empress Marie	21,000	21	same	Ivan Bunge Co.	" Nov. 1, 1913
Catherine II	21,000	21	same	" " "	Laid down Sept. 1, 1912
Battle Cruisers					
Ismailia	28,000	27	9 14-in., 20 4.7-in.	Galerni	" " Dec. 20, 1912
Kinburn	28,000	27	same	Baltic Works	same
Borodino	28,000	27	same	Galerni	same
Navarino	28,000	27	same	Baltic Works	same

"IMPERATRITSA MARIA."—The battleship *Imperatritsa Maria* was launched at Nicolaiev, November 3, for the Russian Black Sea fleet. She is the first of a group of three ships, the second of which, the *Imperator Alexander III*, took the water November 22, and the third, the *Ekaterina II*, followed overboard November 27. They were all laid down October 30, 1911, and are 550.5 feet long, 89.5 feet beam and 27.5 feet draft, with a displacement of 21,000 tons and Parsons' turbines of 27,500 horse-power, designed for a speed of 21 knots. The ordnance will consist of twelve 12-inch guns in four triple turrets and twenty 4.7-inch guns.—*Shipping*, Illustrated.

THE "NAVARIN" CLASS.—Details which have appeared from unofficial sources concerning the design of the four battle-cruisers which have been laid down for the Baltic show that these will be remarkable vessels as regards size and gun power. They have been named the *Navarin*, *Borodino*, *Izmail* and *Kinburn*. Their displacement is said to be 32,000 tons; their speed, 26½ knots; and their main armament nine 14-inch guns in triple turrets, with twenty 4.7-inch guns. Each vessel will cost over four millions sterling. These were the principal new warships in the program sanctioned by the Duma on June 19, 1912.—*Journal of Royal Naval Service Institute.*

THE "MINOGA" SUBMARINE MISHAP.—The crew of the submarine *Minoga* have been rewarded by the Czar for their conduct on the occasion of the sinking of the vessel in the vicinity of the lightship off Libau earlier in the year. It may be recalled that the *Minoga* was at exercises with her full crew of 20 officers and men on board when she sank, owing, it is asserted to a defective ventilator. A tender exercising with her at the time noticed that in diving the *Minoga* plunged rather suddenly, throwing her stern into the air, and therefore kept a sharp lookout for her reappearance. Instead of the submarine, however, the emergency buoy which she carried was observed to come to the surface, and as these buoys not only locate a submarine's position, but also enable telephonic communication to be made with her, it was learnt that the *Minoga* had gone to the bottom and was in need of help. This the tender went off immediately to procure by steaming to the lightship, which telegraphed to Libau dockyard. It being a Saturday, and the accident occurring at three in the afternoon, when the workmen were off duty, it was not until six hours afterward that salvage appliances reached the submarine, and by means of chains fixed to her by divers she

was raised by midnight, having been submerged for nine hours. To get at the conning-tower the vessel had to be hauled well out of the water, which occupied a further three hours, but eventually everyone on board was rescued, although most of the crew were unconscious. This achievement constituted a record for submarine salvage work. It was favored, of course, by the circumstances that the accident happened near a dockyard, in comparatively shallow water, and in good weather, but the value of the emergency telephonic buoy was demonstrated.—*Journal of Royal Naval Service Institute.*

RECRUITING FOR THE RUSSIAN NAVY.—The system of recruiting for the Russian Army and Navy has undergone considerable changes, commencing with the 1913 contingent. The new law on the subject was actually promulgated in 1912, but did not come into force until the beginning of this year. As is well known, recruiting for both services is general, men for the fleet being selected by the recruiting officers according to their aptitudes. Thus the first class to be drawn on for this purpose are men of the mercantile marine with knowledge of signalling, the care of engines, etc.; also pilots, mechanicians, stokers, sailors, etc. Allowing for army requirements, artificers of certain trades are also taken, and the numbers necessary to make up the contingent required are completed by drawing preferentially on the inhabitants of the maritime provinces and the districts bordering on navigable rivers. The term of service is the same as before, viz., five years. Pilots and pilot apprentices, including members of the societies of internal navigation, are exempt from active service, but do ten years in the reserve, the conditions of exemption being that they actually continue during these ten years in the exercise of their calling. Sailors of the mercantile marine who happen to be at sea when they are due to be called up are allowed a period of twelve months—the maximum—in which to comply. Under the new law the class liable for military or naval service now comprises all men attaining the age of twenty years on January 1 in the year in which the drawing takes place, and the contingent assembles on October 1. Volunteers and certain others are exempt from the ballot. These changes have been rendered necessary by the great increase in the demands of the army and navy, the numbers required having trebled during the last forty or fifty years, while the numbers available to be drawn on have hardly doubled during the same period.—*United Service Gazette.*

CONCESSION TO VICKERS, LTD.—We are informed that Messrs. Vickers, Ltd., in conjunction with the leading banks of St. Petersburg, have been granted by the Russian Government a concession to establish extensive gunworks in Russia, and that a company, registered in St. Petersburg, has been formed with a capital of £1,500,000, which has been fully subscribed, to carry out that object.

The concession granted is for fifteen years, during which period Vickers, Ltd., will be technical advisers to the company, which bears the name of the Russian Artillery Works Company. Messrs. Vickers will receive as consideration for their services substantial remuneration in cash and an interest in the profits of the company.

The new gunworks will be at Tsaritsyn, a busy industrial town on the Volga, where land has already been acquired. The company will have the sole rights, after the Russian Government's own works as at present constituted, to manufacture naval guns and field artillery of large and small caliber. The output at Tsaritsyn will also include projectiles and other products for naval and military purposes. The company has also received the rights, in field artillery, of the Deport System, which has been adopted by the Italian Government.—*Page's Engineering Weekly.*

UNUSUAL SHIPBUILDING RECORD IN RUSSIA.—What is to be a world's record in the annals of shipbuilding, both for the number of important ships

launched and keel plates laid in a single town during two consecutive days, was made in the town of Nickolaiev, Russia, on October 31 and November 1 of 1913.

Program for Two Days Mentioned

Keel Plates Laid

October 31, two 1000-ton destroyers, Nevsky Works.
October 31, four 1000-ton destroyers, French Works.
October 31, three 700-ton submarines, Nevsky Works.
November 1, two large cruisers, Russian S. B. Works.

Vessels Launched

October 31, two 1000-ton destroyers, French Works.
November 1, one 24,000-ton battleship, Russian S. B. Works.
November 1, one 600-ton submarine, Baltic Works.

The yards at which these vessels are being built are located on the Ingoul River, and are directly opposite each other. The lofty south bank of the river curves around these shipyards in such a manner that it forms a colossal amphitheater, and offers an unobstructed view for witnessing the launches for more than a mile on either side of the works.

Besides the opportunity of witnessing two successful launches within 30 minutes of each other, the spectators were treated to a military and naval display of mediæval pomp and splendor such as Russia alone can produce without the least affectation.—*International Marine Engineering.*

INFORMATION WHICH THE RUSSIAN GOVERNMENT FORBIDS THE PRESS TO PUBLISH.—The Council of Ministers has approved the following list of news items the publication of which in the press is forbidden by virtue of the Espionage Law of 1912:

News on projected changes in the equipment of the army and navy; on the formation of new army cadres, or changes in the effectives of the army; on the arming of warships, either building or planned; on the repairs of warships; on the quantity of ammunition and other stores for the emergency of war; on the state of preparedness and the strength of fortresses and naval ports, etc., in the event of war, or on work going on at such fortresses or ports; on plans for the construction of new fortresses, or for the extension or dismantling of existing fortifications; on the maneuvers of troops, or gunnery practice by the fleet; on the progress or results of test mobilizations of the army or navy; on the progress of maneuvers or test mobilizations in frontier districts; on the non-granting of leave of absence to officers; on the calling out of reservists; on the non-transfer to the reserve of soldiers who have served their time; on the movements of troops towards the frontier; on the chartering or concentration of merchant vessels in naval ports.—*Naval and Military Record.*

SIAM

NEW CRUISER.—Early in November, the Siamese Government provisionally placed an order with Messrs. Armstrong, Whitworth & Co., Ltd., for a small protected cruiser. Their navy at present includes only one such vessel, the *Maha Chakrkri,* which also serves as a royal yacht.

SPAIN

Spain has already completed one of her three small dreadnoughts, the second is being fitted out, and the third is approaching launching stage. Consequently by the year after next at the latest she will possess four effective battleships (including the *Pelayo,* completed in 1890), three armored cruisers, about half a dozen light cruisers and gunboats still of

effective value, a group of small gunboats, half a dozen destroyers, and twenty-four torpedo-boats of good speed and armament. The Spanish Government, however, is not satisfied that Spain will even then possess an adequate fleet, and it is interesting to learn from *The Times* that a decree has been issued authorizing the Ministry of Marine to present to the cortes a bill for the furtherance of Spanish naval armaments. It will propose the construction of new warships and the thorough equipment of the military ports so as to transform them into useful naval bases. In the district of La Carraca the cost of the proposed artillery and arsenal equipment is put at about £148,000, and the cost of new ships and defence works is estimated at £9,000,000, of which £6,600,000 is to be spent on building three 21,000-ton cruisers—evidently battle-cruisers—£880,000 on eight submarines, and £740,000 on six torpedo-boat destroyers. For the naval equipment of Ferrol, Cartagena and Carraca sums of about £377,000, £960,000 and £2,000,000 have been allocated. At Carraca £330,000 is to be expended on the construction of a floating dock, and £660,000 on dredging, blasting, etc. Two amounts of £55,000 have also been earmarked for petroleum storage tanks and accessories at Ferrol and Cartagena. If this program is carried out, Spain will obtain a fleet of no mean value, considering her strategic position.—*Army and Navy Register.*

SWEDEN

THE SUMMER MANEUVERS OF THE FLEET.—The conditions were that a red fleet coming from the north should run into the Cattegat, attempt to procure a base there and to land troops which were embarked in transports. The red fleet was composed of the coast-defence ships *Oscar II, Manligheten, Dristigheten,* the torpedo-cruisers *Oernen* and *Clas Uggla,* and several torpedo-boats. The blue fleet, made up of the armored ships *Oden, Svea, Thule,* the torpedo-cruiser *Claes Horn* and several torpedo-boats and submarines, as well as two armored gunboats and several torpedo-boats and submarines of the *Gothenburg* division, was to oppose the endeavors of the red fleet.

At the beginning of the maneuvers the red fleet was in the Skager, the *Gothenburg* division in its port and the main body of the blue fleet off Helsingborg. As the blue fleet, being the weaker force, could not engage the red fleet in the open sea, it remained under the protection of the rocky islets in the Cattegat and only sent out scouts to make a reconnaissance; they succeeded in discovering the position of the red transports, in breaking through them in the night and in attacking them with decisive results; before the red fleet could come to the rescue the transports had been destroyed. In the battle that followed the stronger red fleet won; the blue fleet had to withdraw into the shelter of the rocky islets, but had already accomplished its task.

TURKEY

TURKISH BATTLESHIP "RESHADIEH."—The work on this Turkish dreadnought is proceeding rapidly, as the Sultan's Government are anxious to get delivery of her at the earliest date. There seems now to be an end of the many rumors that this ship was likely to be bought by some other power, but as Turkey wants her for her own navy there is no chance of her being transferred. She is likely, it is said, to be ready for delivery in May or June next year.—*Marine Engineering.*

The *Rio de Janeiro,* which is said to have been purchased by Turkey from the Brazilian Government, was laid down in the Elswick yard at the end of the summer of 1911, and should be complete in all respects for sea by next spring. The vessel displaces 27,500 tons, and is thus larger than any battleship hitherto built for the British Navy. She mounts a powerful armament of fourteen 12-inch guns, in seven turrets, all on the center line, besides

twenty 6-inch and ten 3-inch quick-firers, and is expected to attain a speed of 22½ knots. In a single broadside she will discharge 12,900 pounds of metal. The ship is very heavily armored, and it is reported that her cost complete for sea will be £2,900,000.—*Page's Engineering Weekly.*

GUNBOATS.—The names of the four Turkish gunboats that have just been completed at the works of the Chantiers de l'Atlantique at St. Nazaire are the *Chio, Preveza, Tourag Reis* and *Aidin Reis.* They are of 560 tons displacement, 14 knots speed, and fitted with twin-screw engines of 1000 horsepower. They are designed to carry two 4-inch guns, two 6-pounder guns, and two machine guns. The vessels are sheathed with wood and copper and destined for work in the Red Sea.—*The Engineer.*

NEW DESTROYERS.—The Turkish Government has ordered of the Orlando Shipyard, Leghorn, four destroyers of the *Ardito* class of 600 tons displacement, 239.5 feet long, 23.9 feet beam, 15.4 feet draft and 30 knots speed. Four destroyers of the same type now building at the Orlando works have also been sold to Turkey.—*Shipping,* Illustrated.

Turkey has recently concluded a contract with the English firm of Armstrong & Vickers for the re-organization of Turkish naval dockyards. A floating dock will be built in England, as well as most of the armor, guns and machinery for Turkish warships. The company is capitalized at about $5,000,000, under the name Société Imperiale Ottomane Cointeressee des Chantiers et Constructions Navales Anonyme. It is given exclusive rights, covering a period of thirty years, to all government naval construction at Constantinople, together with preferential rights in the construction of other Turkish yards and docks. Only Turkish, English and Canadian workmen, foremen and engineers may be employed. In the event of war, the entire concern is to be turned over to the Turkish Government; and the latter reserves the right of purchase at the end of twenty years.—*Marine Rundschau.*

THE TURKISH WAR FLEET.—We notice that the great ring of shipbuilding interests, known as the Armstrong-Vickers group, has, according to report, been successful in securing the contract for rebuilding and refitting the Turkish dockyards. It has been the intention of the Turks for some years past to resuscitate their war fleet and put their dockyards in up-to-date repair; but the Balkan War upset all their well-laid plans and deflected the money to more immediate purposes. Now that peace has been restored the effort to have a suitable navy for the work of the country is again being made; if rumor is not a lying jade the Turks really mean business, and there will be no question of selling to any foreign power the battleship recently built for them in this country. As they have come to England for their new ships and for officers to re-organize their naval force, they have thought it best, apparently, to also conclude a contract with a private British combination to do for their dockyards what they are asking British officers to do for their fleet, viz., give them a new lease of life by stocking them with up-to-date plant for every description of repair work. New construction will hardly be attempted in Turkish dockyards for some years to come. The Turkish fleet did little but "spar" with its enemies during the recent war, because it had not been thoroughly organized and drilled before the war overtook the country. But if it did not press home its attack on its opponents, it did, at least, prevent the Greeks from creating a diversion in any direction they pleased with the Greek fleet. Great Britain can only wish the Turks well in their present effort to recreate a strong naval force.—*United Service Gazette.*

UNITED STATES

VESSELS BUILDING

Number	Name	Displacement	Speed	Armament	Where Building	Remarks
	Battleships					
34	New York....	27,000	21	10 14-in., 21 5-in., 4 t. t.	N. Y. Navy Yard	Launched Oct. 30, '12
35	Texas.....	27,000	21	same	Newport News	" May 18, '12
36	Nevada.....	27,500	20.5	same	Quincy	Laid Down Oct. 26, '12
37	Oklahoma....	27,500	20.5	same	Camden	" " Nov. 4, '12
38	Pennsylvania	31,400	21	12 14-in., 22 5-in., 4 t. t.	Newport News	" " May —, '12
39	....	31,400	21	same	N. Y. Navy Yard	....

"TEXAS."—The *Texas* and *New York* were authorized by act of Congress approved June 24, 1910, an appropriation of $6,000,000 (£1,230,000) for the construction of each of these vessels being provided; the above sum being exclusive of armor and armament, together with various fittings usually supplied by the government.

The contract for the construction of the *Texas* was awarded the Newport News Shipbuilding and Dry Dock Company, of Newport News, Va., at their bid of $5,830,000 (£1,195,000), the time of completion, according to contract, being 36 months, or December 17, 1913. The keel was laid April 17, 1911, the ship was launched May 18, 1912, and the full-power trial consummated October 28, 1913.

The *New York*, now building at the New York Navy Yard, is also rapidly nearing completion. The two ships are, with the exception of minor details, practically the same as regards hull and machinery.

The principal hull dimensions of the *Texas* are: Length over all, 573 feet; Beam, on load water-line, 95 feet 2½ inches; mean draft, 28 feet 6 inches; block coefficient, 0.61; full-load displacement, 28,367 tons; trial displacement, 26,250 tons; capacity of coal bunkers, 2892 tons.

The batteries consist of ten 14-inch 45-caliber B. L. R.; twenty-one 5-inch 51-caliber B. L. R. and four 3-pounder saluting guns. There are four 21-inch submerged torpedo tubes.

Machinery Arrangement

The general arrangement of the machinery is similar to that of U. S. S. *Delaware*. It consists of the boiler space with three firerooms, having four boilers in each, and one fireroom with two boilers. Two smoke stacks carry off the gases of combustion from the fourteen boilers. There are two engine rooms, divided by a fore and aft bulkhead.

Boilers

The boilers are all of the Babcock & Wilcox make, eight of them having superheaters, while six are without superheaters. Each boiler is fitted for oil burning as well as for coal, either system being capable of being operated singly or together. The total generating surface, inclusive of superheating surface, is 65,480 square feet and the total grate surface is 1554 square feet, making a ratio of 1 to 40. Forced draft is on the closed fireroom system.

Engines

There are installed two vertical inverted direct-acting triple-expansion engines driving twin screws. The specified power of the two main engines

NAVY DEPARTMENT
BUREAU OF CONSTRUCTION AND REPAIR
VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY, JANUARY 9, 1914

Name, type and no. of vessels	Contractor	Per cent of completion			
		Jan. 1, 1914		Dec. 1, 1913	
		Total	Per cent on ship	Total	Per cent on ship
Battleships					
34 New York	New York Navy Yard	95.2	94.6	94.0	93.3
35 Texas	Newport News S. B. Co.	98.1	98.0	97.2	96.6
36 Nevada	Fore River S. B. Co.	52.6	35.5	50.8	32.8
37 Oklahoma	New York S. B. Co.	56.3	51.7	51.6	46.9
38 Pennsylvania	Newport News S. B. Co.	14.4	9.0	14.1	8.6
39	New York Navy Yard	3.2	.....	1.4	.....
Destroyers					
45 Downes	New York S. B. Co.	91.5	91.5	87.2	87.2
47 Aylwin	Wm. Cramp & Sons.	97.4	97.4	97.4	97.4
48 Parker	Wm. Cramp & Sons.	95.2	95.2	95.2	95.2
49 Benham	Wm. Cramp & Sons.	98.0	98.0	93.0	92.8
50 Balch	Wm. Cramp & Sons.	92.6	92.4	92.6	92.4
51 O'Brien	Wm. Cramp & Sons.	36.8	31.0	20.1	13.0
52 Nicholson	Wm. Cramp & Sons.	36.7	30.9	19.1	11.8
53 Winslow	Wm. Cramp & Sons.	33.2	27.5	18.0	10.8
54 McDougal	Bath Iron Works	59.0	55.7	45.4	40.3
55 Cushing	Fore River S. B. Co.	27.9	21.9	24.0	17.8
56 Ericsson	New York S. B. Co.	35.1	32.1	25.2	21.5
57	Fore River S. B. Co.	3.2	.....	.....	.....
58	Wm. Cramp & Sons.	1.3	.....	.....	.....
59	Wm. Cramp & Sons.	1.1	.....	.....	.....
60	Bath Iron Works.	2.2	.....	.....	.....
61	New York S. B. Co.	1.6	.....	.....	.....
62	New York S. B. Co.	1.6	.....	.....	.....
Destroyer Tenders					
2 Melville	New York S. B. Co.	23.0	17.8	15.3	6.0
Submarines					
26 G-4	American Laurenti Co. (Phila.)	96.4	95.5	96.4	95.5
27 G-2*	Lake T. B. Co. (Bridgeport).	89.7	89.7	89.7	89.7
28 H-1	Electric Boat Co. (San Fran.)	†Comp	leted	100.0	100.0
29 H-2	Electric Boat Co. (San Fran.)	†Comp	leted	100.0	100.0
30 H-3	Electric Boat Co. (Seattle)	99.9	98.8	98.9	98.0
31 G-3*	Lake T. B. Co. (Bridgeport)	80.3	80.0	77.3	77.0
32 K-1	Electric Boat Co. (Quincy)	99.2	99.2	94.1	94.1
33 K-2	Electric Boat Co. (Quincy)	99.2	99.2	94.1	94.1
34 K-3	Electric Boat Co. (San Fran.)	90.2	89.5	89.5	88.8
35 K-4	Electric Boat Co. (Seattle)	88.7	87.2	88.4	86.0
36 K-5	Electric Boat Co. (Quincy)	87.5	86.7	83.9	82.3
37 K-6	Electric Boat Co. (Quincy)	85.7	84.4	83.4	81.8
38 K-7	Electric Boat Co. (San Fran.)	82.1	80.6	80.9	79.2
39 K-8	Electric Boat Co. (San Fran.)	80.9	79.4	78.5	76.8
40 L-1	Electric Boat Co. (Quincy)	18.5	14.6	16.2	12.0
41 L-2	Electric Boat Co. (Quincy)	18.4	14.5	16.2	12.0
42 L-3	Electric Boat Co. (Quincy)	18.4	14.5	16.2	12.0
43 L-4	Electric Boat Co. (Quincy)	18.3	14.4	16.2	12.0
44 L-5	Lake T. B. Co. (Bridgeport)	7.4	4.2	7.4	4.2
45 L-6	Lake T. B. Co. (Long Beach, Cal.)	0.0	0.0	0.0	.....
46 L-7	Lake T. B. Co. (Long Beach, Cal.)	0.0	0.0	0.0	.....
47 M-1	Electric Boat Co. (Quincy)	12.4	8.7	11.1	7.5
Submarine Tenders					
1 Fulton	New London S. & E. B. Co. (Quincy)	34.9	27.6	27.8	19.1
2 Bushnell	Seattle Construction & D. D. Co.	12.2	.....	4.5	.....
Fuel Ships					
13 Kanawha	Mare Island Navy Yard	23.7	20.1	14.7	9.1
14 Maumee	Mare Island Navy Yard	15.2	8.6	9.2	0.0
Gun Boats					
19 Sacramento	Wm. Cramp & Sons.	66.1	62.7	57.3	55.1

*Contracts forfeited, vessels being completed New York Yard.
†Delivered at Mare Island Navy Yard, November 29, 1913.

combined is 28,100 indicated horse-power when turning over at the rate of 125 revolutions per minute with a steam chest pressure at the high-pressure cylinder of 265 pounds gage without live steam in either receiver and a mean cut-off in the high-pressure cylinder of .82 stroke.

The general arrangement of cylinders is: Forward low-pressure cylinder, high-pressure, intermediate and after low-pressure, with the high-pressure cylinder leading, followed by the intermediate-pressure, forward low-pressure and after low-pressure in the order named. The high-pressure and forward low-pressure cranks are opposite and 180 degrees apart, which is also the case of the intermediate-pressure and after low-pressure cranks, each pair of cranks being 90 degrees apart.

All the cylinders are fitted with piston valves, one for the high-pressure, 22 inches diameter; two for the intermediate-pressure and each low-pressure 24 and 34 inches diameter, respectively; the travel of each valve being 10, 11 and 12 inches, respectively. The framing is built up of turned and finished forged steel columns, cross-braced and longitudinally connected, bolted to the bed plate and cylinder feet by means of heavy flanges. The valve gear is of the Stephenson type, double bar link middle suspended, open eccentric rods. The crank shaft is hollow forged, in two sections, and the bed plate is of cast steel in sections, bolted together.

The reciprocating parts of opposite cylinders are balanced in weight, and the inertia forces and weights of all piston valves are counterbalanced by fitting to each valve a steam-cushioned balance piston of the Lovekin type. Forced lubrication is provided for all main journals and sliding surfaces. The cranks turn outboard for ahead motion.

The length of connecting rods is 96 inches with a crank ratio of 1 to 4. The cylinders are: High-pressure, 39 inches; intermediate-pressure, 63 inches, and each low-pressure 83 inches in diameter, with a common stroke of 48 inches. Each intermediate-pressure and low-pressure cylinder barrel is jacketed.

The designed distribution of power among the various cylinders is such as to give about one-third the total to each high-pressure and intermediate-pressure cylinder and about one-sixth to each low-pressure cylinder. Despite the inequality in power between the cylinders the guides, piston rods and connecting rods, crossheads and crank pins are all made of uniform size. This greatly facilitates fitting and carrying of spare parts. The piston rings in high-pressure and intermediate-pressure cylinders are made solid, but the low-pressure cylinder piston rings are split and are provided with means for attaining tightness. All valve packing rings are made with a solidly bolted joint, admitting of adjustment for wear.

The cylinder clearances are reduced to a minimum by using practically straight ports. The clearances range from about 12 per cent at the top of the high-pressure cylinder to 17 per cent at the bottom of the low-pressure cylinder. Piston rods and connecting rods, valve gear and other parts under great stress are made of 95,000 pounds tensile nickel-steel; all shafting of 80,000 pounds nickel- or carbon-steel and propellers of manganese bronze.

The outside diameter of all piston rods is 8¼ inches, that of the thrust shafts 17¾ inches, crank shafts 18½ inches and propeller shafting 18¾ inches diameter.

The thrust bearings are of the horseshoe type, water cooled and fitted with forced lubrication.

Condensers

There is installed one main surface condenser for each main engine with a total cooling surface of 13,104 square feet and two auxiliary condensers of 355 square feet of surface each, placed one in each engine room. One dynamo condenser of 2400 square feet of surface is placed in each dynamo room.

Feed Heaters

Two Reilly multicoil feed heaters each of 295 square feet of coil surface are placed in the engine rooms, one in each.

Propellers

There is fitted on each shaft a 3-blade manganese bronze propeller, modified Griffith true screw, the diameter being 18 feet 7¾ inches, pitch 20 feet and the projected blade area 87.9 square feet.

Auxiliaries

In each of the main engine rooms are installed one circulating pump driven by a compound engine, one Blake vertical twin, single-acting air pump, having 35 inches water and air cylinders of 21 inches stroke; two Blake vertical piston double-acting simplex feed pumps, with 9¾ inches water cylinder and 24 inches stroke. In each fireroom there is one auxiliary feed pump of the same type and size as the main feed pump. Besides the foregoing all necessary and usual auxiliaries, such as feed heaters, auxiliary and dynamo condensers, evaporators and distillers, with pumps, fire and bilge pumps, hot well pumps, air compressors, feed tanks, etc., are placed in the ship.

Blowers

There is arranged an independent electrically driven blower set for each boiler, controlled from the boiler room. The motors may be run for a number of different speeds and are, together with the multivane fans, erected in airtight casings placed under the protective deck. These casings communicate with air locks and ventilators.

Trials

The standardization trials of the U. S. S. *Texas* were undertaken by the builders on October 23, 27 and 28 on the government standardization course off Rockland, Me. Of the specified trials the four-hour full-power trial was held October 28, the 19-knot 24-hour trial on October 30-31, the 12-knot 24-hour trial on October 28-29, and the two-hour full-power combination oil and coal trial on October 31.

4-Hour Full-Power Trial

Stem pressure at boilers, gage	295.6
Steam pressure at engines, gage	271.1
Steam pressure at high-pressure steam chest, gage	246.4
Water used by all machinery per indicated horse-power hour of main engines, pounds	15.06
Coal used per hour per indicated horse-power of main engines	1.73
Average air pressure in firerooms, inches water	1.48
Average vacuum in condenser, inches	26.8
Average vacuum in condenser low-pressure cylinders, inches	24.24
Average revolutions per minute	124.56

	Starboard	Port
Indicated horse-power of high-pressure cylinder	4326	4686
Indicated horse-power of intermediate-pressure cylinder	4275	4468
Indicated horse-power of fore low-pressure cylinder	2775	2479
Indicated horse-power of aft low-pressure cylinder	2927	2527
Indicated horse-power total, both engines		28373
Coal used, New River, picked, British thermal units, per pound		14970
Speed in knots		21.05

19-Knot 24-Hour Endurance Trial

Steam pressure at boilers, gage		284.9
Steam pressure at engines, gage		276.5
Steam pressure at high-pressure steam chest, gage		234.3
Water used by all machinery per indicated horse-power hour of main engines, pounds		14.47
Coal used per hour per indicated horse-power of main engines		1.53
Average air pressure in firerooms, inches water		
Average vacuum in condensers, inches		26.82
Average vacuum in low-pressure cylinders, inches		26.53
Average revolutions per minute		110.3
	Starboard	Port
Indicated horse-power of high-pressure cylinder	2840	3014
Indicated horse-power of intermediate-pressure cylinder	3150	2971
Indicated horse-power of fore low-pressure cylinder	1764	1649
Indicated horse-power of aft low-pressure cylinder	1735	1656
Indicated horse-power total, both engines		18779
Speeds in knots		19.078

12-Knot 24-Hour Endurance Trial

Steam pressure at boilers, gage		285.5
Steam pressure at engines, gage		277.7
Steam pressure at high-pressure steam chest, gage		91.94
Water used by all machinery per indicated horse-power hour of main engines, pounds		17.37
Coal used per hour per indicated horse-power of main engines		2.01
Average air pressure in firerooms, inches water		
Average vacuum in condensers, inches		26.71
Average vacuum in low-pressure cylinders, inches		26.2
Average revolutions per minute		69.26
	Starboard	Port
Indicated horse-power of high-pressure cylinder	711	815
Indicated horse-power of intermediate-pressure cylinder	788	716
Indicated horse-power of fore low-pressure cylinder	420	394
Indicated horse-power of aft low-pressure cylinder	420	376
Indicated horse-power total, both engines		4640
Speed in knots		12.137

Besides the foregoing trials an additional full-power trial for combined use of coal and oil was carried out. This trial lasted for two hours.

The steering qualities as well as those pertaining to the seaworthiness of the vessel as developed during the trials were found in every respect satisfactory. The bearing temperatures throughout the trials were steady, no undue heating being prevalent in any of the working parts.

The splendid performance of the vessel from an economic viewpoint, aside from influences of a highly developed design and excellent workmanship, may incidentally be ascribed to steam conditions which show a fair degree of superheat in the high-pressure cylinders and dry saturated steam in the others. The following table gives an idea of what occurred:

Table I

Table of Steam Pressures and Temperatures

	H. P. Cylinder		I. P.	L. P.			
	Engine	Steam Chest	Steam Chest	Steam Chest	Condition of H. P.	I. P.	Steam L. P.
Pressure, gage	274	246					
Pressure, absolute			91.2	26.5			
					Sup.	Dry	Dry
Temperature, degrees F	454.5		322	242.5	40		

An interesting comparison of steam consumption of the machinery of the U. S. S. *Delaware* and U. S. S. *Texas* may be partially inferred from the following table. It is, however, not possible to sharply define the relative economic performances of the main engines alone, as the separate data of water consumed by auxiliaries and main engines on the *Texas* were not obtained. But as the main engines of the *Texas* developed practically the same horse-power as did the *Delaware's* main engines, the horse-power of the auxiliaries of the two ships is probably nearly the same. Furthermore, as the type of the auxiliaries conforms very closely in the two ships, the steam used by said auxiliaries should be approximately the same. The steam consumption per indicated horse-power of the main engines on the basis assumed is given in Table II.

Table II

Full-Power Trial

Comparative Table of Performances of U. S. S. *Texas* and *Delaware*

	Texas	*Delaware*
Steam pressure at valve chest, gage	246.4	253.
Vacuum in condenser, inches	26.8	26.3
Vacuum at low-pressure cylinder exhaust, inches	24.24	20.82
Mean referred pressure	44.08	50.9
Piston speed	996	1027
Live steam in receivers	No	No
Steam jackets	*	†
Cylinder ratio	9.00	7.92
Actual ratio of expansion	11.3	8.71
Superheat at high-pressure valve chest	40° F.	61.6° F.
Forced lubrication	Yes	Yes
Steam consumption in pounds per hour per indicated horse-power of main engines, based on total steam used by main engines plus auxiliaries	15.06	14.79
Steam consumption in pounds per hour per indicated horse-power of main engines, based on total steam used by main engines only (estimated)	13.64	13.32

*I. P. and L. P. cylinder barrels.
†All cylinder and top and bottom I. P. and L. P. barrels.

—*International Marine Engineering.*

FLAGSHIP FOR TORPEDO-BOAT FLOTILLA.—The scout cruiser *Birmingham* has been made the flagship of the torpedo-boat flotilla, and it is expected that with her high speed she will be able to keep pace with the swift-moving vessels during their cruises.

"DOWNES."—The torpedo-boat destroyer *Downes* was launched November 8 at the yard of the New York Shipbuilding Company, Camden, N. J.

"BENHAM."—The Department has been advised that the U. S. S. *Benham* has completed her standardization trials averaging five high runs of 29.81 knots.

"HENLEY."—The second series of speed trials of the torpedo-boat destroyer *Henley* have proved successful, making the vessel ready for acceptance by the Government. The *Henley* developed a speed of 30.3 knots an hour off Sandy Hook, N. J., Nov. 17, a fraction of a knot in excess of contract requirements. On her first trip, some months ago, the *Henley* failed to attain the speed called for in the contract. She was built by the Fore River Corporation, Quincy, Mass., and is of the 742-ton class.

"PARKER."—The new twin-screw torpedo-boat destroyer *Parker*, the largest of its class, and called the "destroyer of destroyers," has been turned over to the government by the builders, and was placed in commission at Philadelphia, December 31.

The *Parker* will be equipped with four 4-inch rapid-firing guns and four twin 8-inch torpedo tubes. When this is completed a company of 100 men, including four officers, will be assigned to the ship. The *Parker* is one of the few oil-burning destroyers in the navy, and with its tanks loaded to their capacity of 300 tons is capable of 7000 miles at cruising speed, or 800 miles at its highest velocity. In the builders' test a speed of 30.33 knots an hour was attained, it is said, while the government requirement called for only 29½ knots.

"G 3."—The submarine torpedo boat *G 3*, built by the Lake Torpedo Boat Company for the United States government, was launched here December 27.

This is the second submarine to be built here, the first having been shipped to Russia.

The *G 3* displaces 500 tons and is expected to make 10½ knots an hour when submerged.

"G 4."—The new United States submarine torpedo-boat *G 4* was given a preliminary trial on November 22 in Delaware Bay. The little vessel made the required speed of 14 knots above water and 9 knots below the surface and was successful in the 200-foot test.

The Lake Torpedo Boat Co. of Bridgeport, Conn., closed its plant December 30, announcing that the government would complete the work on submarine *G 3* owing to the impossibility of the company obtaining enough money at this time to continue. Three other contracts for submarines awarded to the Lake Co. recently, will, it is hoped, be saved from being transferred to competitors by the raising of necessary capital. A committee has been appointed to investigate the affairs of the company and find ways and means of reorganization. The contracts held by the Lake Co. amount to more than $1,500,000. The Navy Department has already taken over a portion of the work contracted for by the Lake Torpedo Boat Co., and it is expected that the closing of the doors of that company will be followed by a decision to finish other submarines under construction by the Lake Co. at one of the navy yards.—*Shipping*, Illustrated.

SUBMARINES CRUISE.—The *Ozark* has just arrived at Hampton Roads from Panama, where she has been acting as convoy to the division of submarines.

These four tiny vessels left Guantanamo, Cuba, on December 7 and proceeded under their own power to Cristobal, at the Atlantic end of the canal, where they now are. This trip, 700 miles in the open sea, marks an epoch in the navigation of submarines. The sea was rough under the influence of strong trade winds during the entire journey, but the boats found no difficulty in maintaining their speed and position for the five days it took to make the trip.

It was feared that the strain might tell on the personnel and that the crews would arrive in a more or less exhausted condition, but the contrary was the case, and the officers and men at the conclusion of the trip were in as good, if not better, condition than at the outset.

The vessels arrived with their fuel tanks over half full and in condition for any service they might be called upon to perform. It is expected that they will remain in tropical waters for some time to come.

"KANAWHA."—The keel of the new navy oil tanker *Kanawha*, to cost not in excess of $1,100,000, will be laid at the Mare Island Navy Yard December 8. As soon as she is launched work will be begun on a sister ship, the *Naumee*.

NEW NAVAL SHIPS.—Much difficulty has been encountered by the Navy Department in obtaining bids within the limit of appropriation for the submarine wrecking pontoon authorized by Congress last March. The Navy Department originally invited bids to be opened on June 24, and this opening has been twice postponed to meet the wishes of a prospective bidder without result. The Bureau of Construction and Repair has in course of preparation modified characteristics of this pontoon with a view to again inviting bids and in the hope that it will be possible to obtain a craft of satisfactory type within the fund available. Bids have been opened at the Navy Department for the construction of transport No. 1 and supply ship No. 1, both of which vessels are new naval types, so far as original design is concerned. The general dimensions and features of transport No. 1 are as follows: Length between perpendiculars, 460 feet; length over all, 482 feet 9½ inches; beam, molded, 60 feet 10⅛ inches; depth at midlength, at side, molded, 39 feet 3¼ inches; mean trial displacement, 10,000 tons; draft at mean trial displacement (about), 19 feet 10½ inches; speed, 14 knots. The general dimensions and features of supply ship No. 1 are as follows: Length between perpendiculars, 400 feet; length over all, 422 feet 11 inches; beam, molded, 55 feet; mean trial displacement, 8500 tons; draft at mean trial displacement (about), 20 feet 8 inches.

RESERVE COLLIERS.—The Navy Department is inviting competitive bids for the construction of vessels intended primarily for the transportation of coal to Panama. These vessels have been so designed as to lend themselves readily to conversion to the government type of colliers, and will therefore be capable of forming valuable adjuncts to the fleet if necessary in time of war. They will be 522 feet over all, 500 feet b. p., 62 feet beam and approximately 28 feet draft loaded with a sea speed at the load draft of 14 knots. They will be fitted up to provide comfortable quarters for a crew of about 144 men and 26 officers. They will be of the twin screw single-deck type, fitted for carrying and handling of cargo coal, and will have provision to permit, when desired, the carrying of fuel oil. They will be of the raised forecastle and poop deck type, fitted with a poop deck house aft. The navigating bridge structure is located abaft the break of the forecastle and includes provision for bridges, cabin, chart room, and radio room. The vessels will have double bottoms throughout their entire lengths, and will be fitted for carrying water ballast in peak tanks forward and aft, as well as in topside ballast tanks. The vessels will be divided by watertight bulkheads into four large cargo holds, each fitted with two large hatches. In addition four compartments will be provided forward to carry either bulk freight or oil. These compartments will be separated from the cargo coal holds by means of a cofferdam. Especial attention has been given to the arrangement of the vessel's bunker coal in order that self-trimming may be obtained to the greatest extent possible. Accommodations for the officers and crews will be unusually commodious. The fittings and finish of quarters will be in accordance with the practice obtaining in colliers in the U. S. Navy. These vessels will have fore and main masts, with the usual provisions for the radio outfit. They will be fitted with special appliances in order to facilitate the rapid handling of the cargo.—*Shipping.*

In the submarine *F 1* there will be tried out an apparatus which shows the trim and depth, for assisting in controlling the depth. It is based on the principle of the Cartesian diver and consists of a glass jar filled with a fluid in which floats a model of a submarine. The fluid is the secret of the inventor, Smith. On the container scales are marked which show the depth in meters. When the submarine submerges, the model also sinks in the fluid in the glass jar and the model also changes its trim to conform to that of the boat.—*Marine Rundschau.*

SUBSTANCE OF SECRETARY DANIELS' REPORT.—The annual report of Secretary of the Navy Daniels recommends that Congress should provide for the construction of two dreadnoughts, eight destroyers and three submarines. The Secretary admits that this is not a large program, but says that "it is a progressive one," and meets the demands to go forward in the continuation of "an adequate and well-proportioned navy." He also advocates a steady building program of advancement from year to year which is necessary to give us an adequate navy, the goal of American needs and desires. A large part of the report is taken up with urging upon Congress the wisdom of enacting legislation that will make provision for the Navy Department to refine its own oil from its own wells, in view of the growing use of that fuel in the navy and the tendency of private concerns to charge excessive prices therefor.

PERSONNEL.—By January 1, 1914, it is expected that the navy will be enlisted up to authorized strength of 51,500. Last January it was about 5000 short of its authorized strength, but has been rapidly increasing until on November 19 there were 49,854 enlisted men in the navy. Not only are there many recruits coming into the navy, but since January 1, 1913, about sixty per cent of the men have re-enlisted.—*Army and Navy Journal.*

ORDNANCE AND GUNNERY

AIRCRAFT-DESTROYING GUN.—Experimental shooting took place at the Needles Battery, Isle of Wight, on November 28, with the new aircraft-destroying quick-firing gun. About 20 rounds of bursting shell, presumably shrapnel, were fired at three large box kites towed at a great height and speed by a destroyer. Shell after shell burst right among the kites, two of which appeared to be shattered.—*Army and Navy Gazette.*

THREE-INCH GUNS FOR SUBMARINES.—The Navy Department has placed orders for twelve 3-inch guns for mounting upon the latest submarines. The Naval Bureau of Ordnance has now come into line with the British and German authorities in thus equipping their underwater craft. These guns will be mounted after the usual fashion, being elevated and lowered into the hull, and fitted with a piece of deck plating which will serve as a shield to the gunners.—*Shipbuilding.*

THE PRESENT VALUE OF ARMOR.—Now it must be remembered that, apart from any increase of caliber, muzzle energy, and bursting charge of shells, the accuracy of modern ordnance has been increased in the last seven years enormously, the number of heavy guns carried has grown from four to ten, and the rate of fire per gun has improved by 50 per cent. That is to say, that ships with a typical modern broadside of ten guns—making the reasonable assumption that hits per gun per minute are at least double of what they were till only recently—are able to make no less than seven and a half times the number of hits in a given period of time, and if 13.5-inch shell are contrasted with the 12-inch of 1905, can, in that time, theoretically execute fifteen times the havoc possible at that period. The resistance of armor has not increased in anything like that proportion, but even if it be granted a fair measure, it will be seen that a modern ship has a potential value for destruction ten or twelve times what it was eight years ago, and this figure is enormously augmented when the greater ranges now attainable are also brought into consideration. What the value can be of the 8-inch and 9-inch side armor, or even of the narrow 11-inch and 12-inch water-line belts of all the British dreadnought class is hard to determine in face of figures like this. The real fact is that, though the armor is penetrable, it is only penetrable by projectiles of a less dangerous nature than would be

employed if the armor were thinner or non-existent. That is to say, one is forced to attack the ship with a shell having a smaller bursting charge in proportion to its weight. Hence, penetration is assured by directing a group of shells on to one spot, but the individual effect is less than it would be if the shell were designed to attack thinner armor. Naturally, internal structural arrangements have also been far more widely made to form subsidiary protection arrangements, but they are primarily intended as defences against mine or torpedo attack.

The experiment which would throw more light than any *Belleisle* or *Empress of India* experiments on this very vexed question would be to let two of the most modern vessels fire, at most, two rounds each at one another at 8000 yards range, at which distance it is at present supposed that a modern high explosive armor piercing projectile would be able to perforate 11 inches. That the cost would be high—enormous, in fact—is admitted, but the results would, we consider, go to show that the gun is still greatly underrated and that armor attached to a ship does not possess its apparent proof ground penetration by a very considerable margin. For it must not be forgotten that modern methods of fire control with range finders accurate to 2 feet per 1000 yards, can place at four miles distance five simultaneous shell of the largest size in an area less than that occupied by a tennis court, and where a solitary shell might not succeed, the result of such a repeated blow is obvious. It would almost appear that the penetrability of modern armor under such conditions must be accepted, or that a radical change in design, directed towards a readjustment of balance of power between gun and armor, must make its appearance before long.—*The Military Record.*

THE RESISTANCE OF GUNS.*—Captain Hector Bravetta, of the Italian Royal Navy, who is well known to students of naval matters on account of the many articles which he has contributed to technical reviews in Italy and abroad, has translated and united in one volume three important memoirs on the resistance of guns, which engineers Leon Coupaye and Peter Malaval (of the French Naval Artillery) had published in the *Mèmorial de l'Artillerie Navale.* From the instructive preface in which Captain Bravetta introduces the authors to the public, and in which he summarizes their ideas and places in evidence the results arrived at, we note that the above-named memoirs are three in number, two being due to Mr. Coupaye, and one to Mr. Malaval.

The first of Engineer Coupaye's memoirs, which is entitled "Notes on the Calculation of the Transversal Structure of Guns," is the exposition and development of a method for calculating the resistance of artillery, *based solely on the limitation of the tangential dilatations,* the only factor which, up to the present time, has been taken into consideration, possibly on account of a mistaken notion, that it is the simplest mode of calculation.

The author has treated the problem in a generical manner, and has therefore been enabled to discuss the elastic limit to be adopted, for the elements of each section, and it is for this reason that in his second memoir, "Elastic Deformation of the Straight Cylinder, Guns with Purely Elastic Deformations," he limits himself to the calculation of a gun of which deformations are always elastic and never permanent; he presents the general lines of his subject only, and refers the student requiring a more complete treatment to the analogous questions which are dealt with in the first memoir.

In his second work, Mr. Coupaye has developed the study of the deformation of the straight cylinder; a study which, as far as we know, had not yet been dealt with, and which could and should by itself alone indicate the limits of application of the generic formulas used and their

*Recent studies of Leon Coupaye and Peter Malaval, engineers in the French Naval Artillery. Translation and preface by Capt. Hector Bravetta, Italian Royal Navy.

value. The result of this study is most important, for it has clearly brought into evidence that, calculating the strength of artillery, the end which the constructor of cannons has in view must in the generality of cases be taken into account; which end consists in the construction, at least practically, of a gun which, while firing, is affected only by elastic deformations.

The fact that the radial might become greater than the tangential deformation was already known and Kaiser has taken this point into consideration in his celebrated work; however, the exhaustive treatment of the matter by Engineer Coupaye has brought into evidence a most important circumstance, which has, up to the present moment, escaped the attention of constructors of artillery, *i. e., that it is absolutely impossible to build guns having purely elastic deformations* of a power superior to the limit of elasticity of the metal of which the internal tube is made and that the power effectively and practically realizable is about equal to nine-tenths of such elastic limit. This is true, whatever system of manufacture be adopted, both with regard to built-up and wire-wound guns, so that Captain Bravetta is correct in observing that the conclusions of Engineer Coupaye dispose of the legends as to the extraordinary powers of resistance attributed to guns constructed on this latter system, of which he requires the abolition in view of the considerable disadvantages which are inherent to such weapons.

The laws of elasticity have, therefore, proved in an irrefutable manner the following points: The elastic resistance of a gun is very limited, for, if the metal forming the internal tube possesses, for example, a limit of elasticity of 40 kilos, a piece of artillery of normal thickness will become deformed in a permanent manner under an internal pressure of 3600 kilos or more per square centimeter. Therefore, with weapons as at present constructed, it is impossible to fire at a higher pressure than that considered as normal. This does not necessarily mean that the present artillery must always burst transversally under the action of an internal pressure superior to the normal; in fact, it is known that with modern steel there is an appreciable difference between the limit of elasticity and that of rupture, which constitutes a precious margin of security for the system; however the permanent deformation which would follow, would be of such a nature as to modify the reciprocal relations of the various parts of the gun and would also influence the behavior of the projectile in the barrel. At all events the whole of the gun would not be invariable and would always be exposed to the danger of a pressure exceeding, even slightly, the relatively small pressure which produces permanent deformations; the limitations resulting are a most serious hindrance in view of the modern tendency to adopt ever-increasing pressures.

As will be seen from the preface, the calculation of artillery on the basis of radial deformation is not only useful, but absolutely necessary where it is required to use relatively high pressures, and Captain Bravetta has most opportunely summarized the investigations made on this subject by Engineer Bianchi, lieutenant-colonel in the Italian Artillery, who has sought the formulas necessary for such calculations, demonstrating that they are not more complicated than those now in use based on tangential dilatations; the observations and conclusions of Lieutenant Colonel Bianchi are of great interest and importance.

Engineer Malaval has also demonstrated that the present pieces possess an elastic resistance not greater than nine-tenths of the limit of elasticity of the metal forming the internal tube; the maximum importance of his researches, however, consists in the fact that he demonstrates the possibility of constructing guns capable of supporting the enormous pressure of 10,000 kilos per square centimeter, without any deformations resulting when the piece returns to a state of repose.

Mr. Malaval has brought these facts into evidence during the course of his special and profound investigations of the deformation of the tube

beyond the elastic limit of the metal of which it is constructed; he has shown that a plain tube, when it becomes deformed, assumes of its own accord the ideal constitution of continuous forcing which would result from the union of an infinity of infinitesimal tubes put together in such a manner that they simultaneously reach their limit of elasticity, and, in consequence, all act equally under the application of an internal pressure. To put the matter briefly, Mr. Malaval would substitute partial forcing, by the continuous forcing realized by the autoforcing of the tube under the action of pressures which deform it in a permanent manner. On the other hand, this deformation results in a new state of elastic equilibrium which will remain invariable until the internal pressure (to which the tube will afterwards be submitted) exceeds the maximum of deformation. This new method, which leads to the consideration of the utilization of practical or accidental pressures, greatly superior to those now in use, will also permit, without doubt, an economy in the cost of workmanship, as the guns, remaining of the same thickness as before, may be built up of a lesser number of elements.

It will therefore be seen that the essays under consideration are of a most important nature, meriting attentive study on the part of land and marine artillery services. We would also call the attention of our readers to the preface, in which are expounded many ideas worthy of serious consideration. In the construction of guns it is important, even more than in the case of other machines, to follow the path of progress, it being a dangerous matter to tread stubbornly the beaten way, out of habit, over-conservatism, or worse.

Apropos of this matter it is most interesting to note that the Italian R. Navy, which has for some years past adopted exclusively the wire-wound system of construction, has now abandoned this, and is at the present time constructing some of her new colossal 381 millimeter guns on the built-up system. This fact gives a character of great actuality and interest to the work of engineers Coupaye and Malaval, Lieutenant Colonel Bianchi and Captain Bravetta, as it indicates to a certain extent the technical trend which is being followed in Italy, a pioneer country in the matter of progress and much esteemed for the high intellectual capacities of her officers, who make a point of keeping themselves in touch with all matters appertaining to scientific progress, with a view to their practical utilization.

Turin, 1913. Editor Carlo Pasta, Piazza Castello, 22.—*Journal of the United Service Institution.*

A NEW KRUPP SELF-LOADING GUN.—The firm of Krupp, at Essen, Germany, have produced a new 50-caliber self-loading gun of 10.5-cm. (4-inch) bore, in which the opening of the breech, the ejection of the empty case, the loading of a fresh cartridge and the closing of the breech are effected automatically. This new gun is of a type between the semi-automatic and the automatic. On account of its great rapidity of fire and also because it can, in case of need, be operated by one man, it is particularly adapted for a torpedo-defence gun.

The breech mechanism is of the ordinary Krupp type, fitted with the usual safety devices; it can be operated by hand if desired. The gun-slide surrounds the gun and rests in the trunnions of the carriage of the center-pivot mount. The recoil is taken up by means of the usual hydraulic brake. Two counter-recoil springs return the gun to battery. The hydraulic brake and counter-recoil springs are under the gun-slide. The magazine is placed on the gun-slide which does not recoil. The magazine holds from 5 to 6 cartridges, according to the caliber. The gun will, therefore, fire 6 or 7 shots, including one cartridge in the gun. The last shot is fired by pressing on a firing-knob so that for continuation of the magazine-fire it is only necessary to refill the magazine, loading by hand not being needed. Single shots can be fired, the magazine remaining filled. Automatic firing is also

arranged for. Three men form the crew of the gun, but it can be operated by one man in case of necessity; as remarked above.

The operation of the self-loading apparatus is as follows:

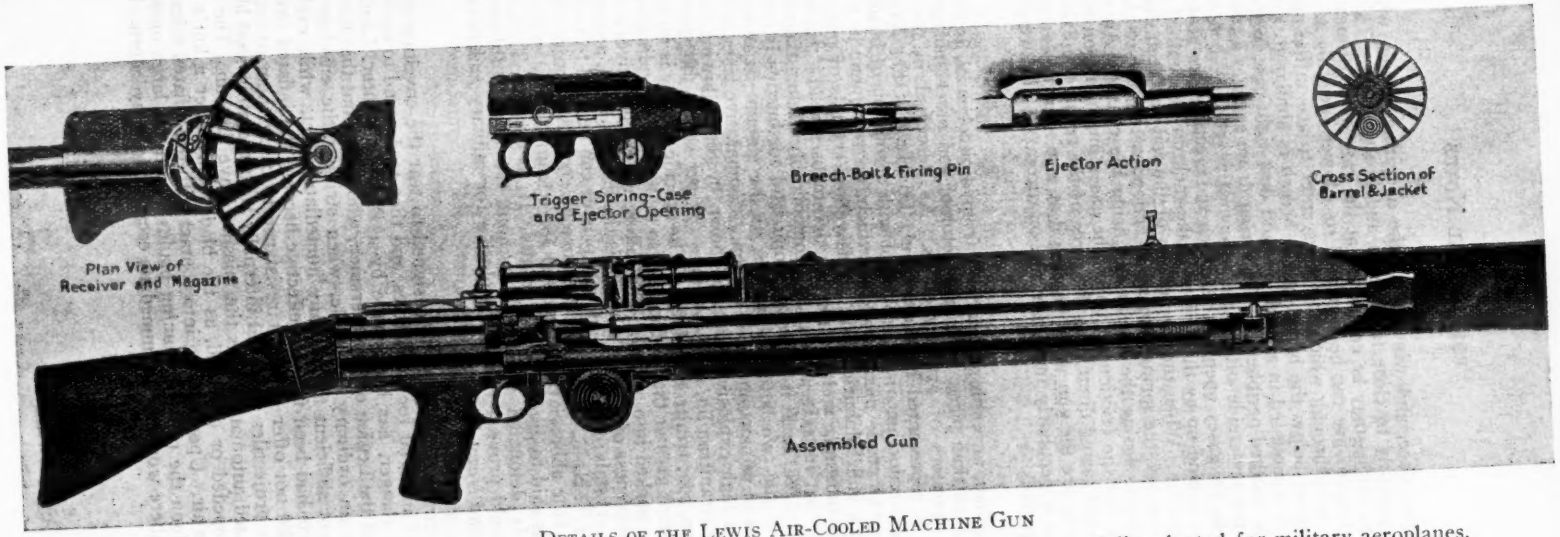
The recoil of the gun stretches the opening and closing springs of the breech mechanism and also extends the magazine spring, all of which are held in their state of tension by means of catches. Shortly before the end of counter-recoil the breech is opened by release of the opening spring, the empty cartridge case is ejected in the usual way, and then the magazine spring is tripped and the loading gear brought into action. The loading tray with the fresh cartridge (bottom) is brought into position in rear of the breech and shoved into the chamber. The closing spring is then released and the breech closes. The loading tray returns to its original position and releases the catch which retains the cartridges in the magazine during the movements of the tray, and a fresh cartridge takes its place in the tray.

The new gun (10.5-cm., 4-inch) is 5.25 m. (16.4 feet) long and weighs 2150 kg. (4730 pounds), including the breech mechanism. The gun-mount weighs 3450 kg. (7590 pounds) without the shield. The cartridge weighs 16 kg. (35.2 pounds); the initial velocity is 935 m. (2922 feet) per second and the maximum range 12,500 m. (13,020 yards). With a 5-cartridge magazine the gun can attain a rate of fire of 30-35 shots per minute.—*Mitt. aus dem Geb. des Seew.*

A NEW MACHINE GUN.—Messrs. Ehrhardt, the well-known German ordnance manufacturers, have brought out a new machine gun for which many practical points of excellence are claimed. It is on the barrel-recoil system with belt feed, and the novelties consist in the details of the breech mechanism, which is a strong and remarkably simple action. The barrel is water-cooled right down to the breech, and can be exchanged, when it becomes warm, in twenty seconds. The machine gun is sighted with ordinary and telescopic sights, and is mounted on a stout tripod; the shooting is said to be unusually good. The range scale is marked on a glass plate in the field of the telescope, so that the elevation can be altered without taking the eye from the sight, and it can be illuminated for night work. The machine gun weighs 37 pounds and the tripod 69 pounds complete.—*Army and Navy Gazette.*

THE LEWIS AIR-COOLED MACHINE GUN.—We present illustrations of an air-cooled machine gun, the invention of Col. I. N. Lewis, formerly of the United States Army, which has been undergoing firing trials successfully in Russia, Belgium, Italy, Austria and Sweden, and is now being tested by a special board of officers of the United States Army. Colonel Lewis is known to our readers as the inventor of the Lewis depression rangefinder, which is in service on the coast defence batteries of the United States seaboard.

Two problems of special difficulty confront the designer of an automatic gun timed to fire a large number of shots at high speed, namely, keeping the barrel cool, and feeding the loaded cartridges and ejecting same when empty. By studying the accompanying illustrations, it will be seen that the barrel is inclosed in a close-fitting jacket, made of aluminum and formed with a number of radiating longitudinal fins. Fting closely over the outside edges of these is a light steel casing 3¾ inches in diameter. This extends beyond the forward end of the barrel. At each discharge the blast of gases from the muzzle acts as a kind of pump plunger and sucks currents of fresh air through the V-shaped channels surrounding the barrel. There is a passage of fresh cold air at each discharge, and this serves to cool the breech-operating mechanism. Colonel Lewis describes the action as follows: When the gases act on the piston, the energy stored in the moving mass overcomes the resistance due to the work of unlocking the breech, extracting and ejecting the shell, turning the magazine to bring the next



DETAILS OF THE LEWIS AIR-COOLED MACHINE GUN

This gun, weighing only 26½ pounds and firing 800 shots per minute at maximum speed, is specially adapted for military aeroplanes.

cartridge into place, and winding up the operating spring, which spring serves subsequently to close the breech and fire the shot. This complete series of operations may be completed at the rate of 800 times a minute; but the rapidity of fire can be regulated to a lower speed by adjusting the area of the hole through which the gases enter to act on the piston. The operating spring below the barrel at the breech is similar to that used in clocks, and it is mounted in a small oil- and dust-tight case in front of the trigger. The toothed periphery of the spring drum engages a toothed rack, formed on the underside of the piston operating rod. When the last is driven back by the gases, opening the breech and ejecting the spent cartridge, the spring is wound up by the action of the rack on the toothed periphery of the spring case. When the momentum of the rod has been expended in its backward travel, the spring comes into action, casting the rod back to its starting position, closing the breech and firing the charge. An additional advantage is that the friction set up by the gases impinging on the end of the tubular steel casing diminishes the force of the recoil one-half. Hence, it is possible to fire the gun when holding it at arm's length—an advantage which makes it peculiarly fitted for use on aircraft. The weight of the gun is 26½ pounds.

Tetranitranilian, an explosive derived from dinitrobenzol, is claimed to be more efficient than picric acid, trinitrotoluol and other substances now used as the bursters of artillery shells. As described in the *London Engineer*, it is represented by the formula C6 H2 (NO2)4 NH, and is obtained by the reduction of dinitrobenzol with a solution of bisulphate of soda. This gives crude metanitranilin, which, on treatment in the usual way with nitric and sulphuric acids, yields yellow crystals of pure tetranitranilin. This substance melts at 130° C., decomposes at 215° C., and puffs at 220° C., so that its safety limits are considerably higher than those of picric acid and T. N. T. It is not hygroscopic, and combustion is more complete than with the two latter substances, as the amount of oxygen contained is larger in proportion to the carbon. Comparative tests in the lead cylinder give a high explosive force, as shown by the following values of distension: Tetranitranilin, 430; dynamite (75 per cent), 300; picric acid, 297; gun-cotton, 290; trinitrotoluol, 254. The specific gravity is no less than 1.87, or 15 per cent greater than picric acid, so that a correspondingly greater amount can be packed into a shell. The falling weight test gives a relative degree of sensitiveness of $h = 50$, where h is the height of fall, as against 60 for picric acid crystals; so that the new explosive can be used to reduce the sluggishness of T. N. T., for which substance $h = 90$. A mixture of 20 per cent T. N. A. (the abbreviation suggested for tetranitranilin) with 80 per cent T. N. T. is said to give excellent results. If, as claimed, T. N. A. can be satisfactorily detonated in a shell without the use of fulminate of mercury, it should prove a valuable explosive for military and naval purposes.—*Army and Navy Journal.*

A NEW PROJECTILE.—A projectile designed to tear the envelope and explode the gas of an aerial foe's dirigibles, and then to descend to earth with a minimum of danger, has been made by a British inventor, Lieutenant Clifton West, of the Legion of Frontiersmen, who points out that the damage created by an ordinary projectile, when striking the envelope of a dirigible, was not sufficient to take any immediate effect, while explosive shells and bullets had been found ineffective because the inflated envelope of a dirigible did not offer sufficient resistance to cause them to explode. The lieutenant's projectiles are fitted internally with radiating steel blades, which are released automatically as the missiles leave the gun. The flight is in no way impeded or deflected, as the blades only offer a knife edge resistance to the air. Upon coming into contact with the inflated sides of a dirigible or balloon the rapidly spinning blades would cut large openings, through which there would be an immediate escape of the hydrogen. Each

projectile, it is claimed, will pass through the air with a tail of fire like a comet. "Nothing explosive or inflammable is utilized," he declared, "but from the instant the projectile leaves the mouth of the gun it is in action, ready to ignite any hydrogen or gas through which it may pass. The projectiles could also be used as 'tracers' in land warfare, as in the dark the passage of the shot could be easily followed, owing to the trail of fire continuously emitted while the projectile is revolving. Although used with such deadly effect against airships, the projectiles, being in themselves non-explosive, offer the minimum amount of damage with their return to earth, and are quite harmless before being fired." Lieutenant West's missiles, it is said, can be made in any size, and no alteration in existing guns is required for firing them. They can even be adapted for quick-firing weapons for use from an aeroplane. Important and exhaustive tests of the invention are now being made, says the *London Daily News.—Army and Navy Journal.*

TARGET-PRACTICE EXPERIMENTS AGAINST THE OLD "EMPRESS OF INDIA."—The target-practice experiments against the old battleship *Empress of India* took place on November 4, 1913, some thirty miles from Portland in the vicinity of West Bay out of sight of land. The First Lord of the Admiralty and his colleagues witnessed the firing.

The ship had all her guns and fire-control installation on board so that the guns, barbettes and fire-control installation might be subjected to the effects of bombardment.

According to the program single ships as well as groups of ships were to fire at the target, both at the shorter ranges with individual control, and at the greater ranges with the complete ship's fire control and Sir Percy Scott's fire-director. The small ships with their light-caliber guns were to open the firing followed by the battleships and battle cruisers firing at ranges between eight and nine sea-miles. All ships were to steam at high speed and make frequent changes of course, so that the practice might simulate the condition that would obtain in battle.

Target-practice at such great distances is well adapted to furnish valuable data as to the reliability of present-day methods of fire-control when employed at the greatest possible ranges.

How much was attained as a result of the carrying out of the experiments cannot be learned. The first onslaughts were made by individual ships, which severely peppered the target with their smaller weapons. Then the 12-inch guns were used, and finally the 13.5 inch guns were fired at a range of over eight miles. When the squadron firing by the Second Battle Squadron took place, the *Empress of India* showed signs of doom. Flames burst out, and a pause was made in the bombardment while tugs pumped water on to the burning ship. Holes like lock gates were made in the side of the ship, and as each shell struck her she heeled over to a considerable angle. It was after the return of the fleet to Portland that she sank in moderately deep water. This contingency was unexpected because every care had been taken to increase buoyancy, in order to be able to inspect the effects of the hits.—*Mitt. aus dem Geb. des Seew.*

RUSSIAN GUNNERY PRACTICE.—Experiments have recently been carried out by vessels of the Black Sea fleet with the obsolete battleship *Tchesmé* as a target. The damage effected by the firing caused the ship to founder. A 12-inch shell which entered slightly below the water-line amidships cut a clean hole through the 16 inches of compound armor which the *Tchesmé* carried and sent her to the bottom. The *Tchesmé* was launched at Sebastopol in 1886. The armored cruiser *Bayan* has received the prize offered by the Tsar for the ship holding the gunnery record in the Baltic fleet.

GUNNERY PRIZES FOR ITALIAN FLEET.—The prizes for gunnery, torpedo practice and efficiency of machinery, awarded to the officers of the Italian fleet who took part in the late grand maneuvers off the Sardinian coast,

were given away by the Duke of Genoa and the Duke of the Abruzzi on board the *Dante Alighieri* in Spezia arsenal on November 8. Among the recipients was the group of engine room officers of the *Roma*, who won especial praise in view of the comparative age of the engines and the hard service they have seen. It is now four years and a half since Ansaldo made the engines over to the Italian Government after the final trials. During this period they have been always in active service, including that of the entire campaign during the war. They develop 785 horse-power in excess of the contract when under forced draft, and 565 horse-power more than the estimate when under natural draft; and impart to the ship a speed of 22 knots in the first case and of 20.8 knots in the second. It was said at the ceremony that the machinery of the *Roma* is still in perfect condition, and that not one of the boiler tubes has as yet been changed.—*The Engineer.*

BATTLE PRACTICE.—It has been stated that the autumn battle practice of the Italian fleet was carried out this year on a larger scale than ever before. Every commissioned ship took part in the firing, the conditions for which were more severe than on former occasions. The scene of the practice was the Gulf of Aranci. For the battleships and cruisers with heavy high-powered ordnance the opening range was fixed at 8000 meters, and all the targets were towed. The King of Italy was present on board the *Dante Alighieri.* The authorities have decided not to publish any particulars of the practice, but according to Italian papers the results showed a marked increase in efficiency for all classes of battle weapons. This is believed to be the first time that towed targets were exclusively used in Italian battle practice. The armored cruiser *Amalfi,* which carries four 10-inch and eight 7.5-inch guns, is stated to have been the best ship in the second squadron. In addition to individual practice, both by day and night, the vessels, according to the Roman *Tribuna,* fired in divisions, and the King's prize for the best divisional firing was won by the first division of the first squadron, which includes the newest ships, headed by the dreadnought *Dante Alighieri.* —*Journal Royal Naval Service Institute.*

TARGET PRACTICE. FRANCE.—In August, the 2d cruiser squadron carried out night target practice under the following conditions: Three targets 10 m. long and 3 m. high, to represent 3 destroyers, were placed 200 m. apart. The course of the firing ship was marked with light buoys to pass within 700 m. of the targets. The speed was unknown to the batteries; the permission to open fire was given by a member of the gunnery board of the squadron; firing was stopped three minutes after opening fire. The targets were changed after each run of each ship and the hits counted. The total number of hits was to be penalized from 30 per cent to 60 per cent if only one or two targets were fired at; however, no ship incurred the penalty. The *Conde* did the best shooting. Details of the results are not known.

"FEI CHUNG." GUNNERY TRIALS. CHINA.—The gunnery trials of the *Fei Chung* took place on October 12, off the American coast. The armament consists of two 6-inch, four 4-inch, two 3-inch, six 3-pounder automatic guns, and two 1-pounder automatic guns. Four rounds were fired from each gun at various angles of training and elevation to put the installation of the armament to the greatest possible test. Following on the gun trials the trials of the torpedo installation took place. This consists of two 18-inch above-water Elswick pattern torpedo tubes. Dummy torpedoes were fired from each tube both by air and cordite impulse, after which runs with a Whitehead torpedo were made. The guns, mountings, and tubes went through their trials with complete satisfaction. The *Fei Chung,* which has been built by the New York Shipbuilding Company, is a similar armament to that of the *Chao Ho,* built at Elswick. The armament for both vessels was supplied by Sir W. Armstrong, Whitworth and Co., Limited.—*The Engineer.*

RADIO

SUBMARINE SYSTEM SUCCESSFUL.—Christian Berger, of Hungary, the inventor of the signaling system for submarines, recently made a visit to Newport, R. I. Mr. Berger supervised the installation of his system on the submarines now building at Quincy, Mass.

The Berger method is a marked success, say the authorities who have conducted trials in this country, and the apparatus has been perfected by the inventor until communication can be established between immerged vessels within a radius of seven miles. It is said that the system will be installed on many battleships of the American Navy. Count Szechenyi, husband of Gladys Vanderbilt, is interested in the Burger system.—*The Wireless Age.*

RADIO EXPERIMENTS.—The U. S. Naval Observatory succeeds in receiving time signals from the observatory of Paris by radio telegraphy via the Eiffel Tower and Arlington for longitude determination. For about three weeks the Naval Observatory at Washington and the Observatory of Paris have been sending time signals to each other, using the Arlington radio station and the Eiffel Tower, in a campaign to determine the difference of longitude between the two places and the velocity of propagation of radio signals through space. Owing to interference from other radio stations, but principally to discharges of atmospheric electricity, there has not been much success until November 21, when the beats of the Paris clock as transmitted by radio signals were compared with the Washington clock for some minutes by the method of coincidences. The season of the year when atmospheric conditions are best for radio work is now coming on, and it is expected that the work in which the American and French commissions are engaged will proceed as planned.—*Army and Navy Journal.*

THE F-RAYS.—For years past electricians have been promising us a new ray, which, when concentrated on a distant point, shall produce a molecular vibration, sufficient to explode gunpowder, and so destroy an enemy's magazines. The first scientist to realize this promise, if only on a small scale, is an Italian engineer, Signor Ulivi, who has produced a new form of electric wave called the F-Ray. With this he is able to explode a percussion cap at a distance of one meter. From this to the destruction of a battleship at ten miles is a long step; but great things spring from small beginnings, and electricians assure us that their science has by no means said its last word in modern warfare.—*Army and Navy Gazette.*

OPENING OF RADIO SERVICE WITH GERMAN COLONIES.—The German Imperial Postoffice has announced that radio communication between Germany and the German colonies in Africa will be in operation on May 15, 1914. Nauen will be the home station in Germany; the activity there is very great in order that the necessary installation may be gotten ready. For reliability of communication under all circumstances there has been built a tower 250 meters high in addition to the five already built which are each 120 meters high.

OPERATING A TORPEDO FROM A LAND STATION.—United States army and navy officers are deeply interested in a mechanism invented by John Hayes Hammond, Jr., for operating a torpedo by non-interferable radio impulses from a land station. To bring about the realization of the system necessitated, it is said, the taking out of fifty patents and the expenditure of thousands of dollars and an immense amount of labor at the Hammond Radio Research Laboratory in Gloucester, Mass.

Considerable secrecy surrounds Mr. Hammond's mechanism, and he said in response to a request from *The Wireless Age* for information regarding his invention that "inasmuch as the U. S. army officials are cooperating with me to-day in my work you will, of course, understand that all the matters of my laboratory are confidential." He has, however, it

was learned, brought his invention to such a degree of perfection, after many months of experimenting, that officers of the navy and army have agreed to witness his tests.

Hitherto it has been possible to operate a torpedo from shore at an eight-mile speed, but the control has always lacked the fundamental essential of immunity from interference by an enemy. That is, a hostile battleship against which a land-operated torpedo might be directed, could, with its own wireless radio impulses, interfere and negative those of the land station.

Mr. Hammond's invention is credited with making such interference a boomerang for an enemy, for with his new device, in case intereference is attempted, the radio forces impelling the projectile, instead of losing their efficiency, are strengthened, and the torpedo is drawn toward its mark at an increased rate of speed.

In the little bay near Gloucester harbor's mouth, beneath the bluffs, where tower the twin finger-like wireless masts, 360 feet high, which Mr. Hammond has built, lies a fifty-foot "house boat" recently remodeled for wireless control operations which the inventor, standing at a mysterious keyboard in his laboratory, can at will put through its paces out in the bay —two, three, four miles from there, running at a twelve-miles speed, turning, stopping, backing, starting forward again, without interference by any one on board if there happens to be any one.

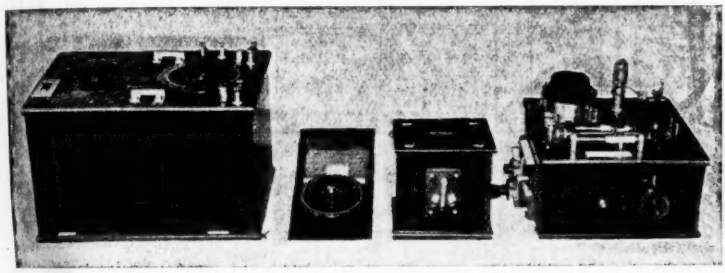
The predecessor of this "house boat," the *Radio*, a speedier type, was operated by wireless waves at a thirty-three-knot rate. When the navy experts heard of this and satisfied themselves as to its truth, they requested Mr. Hammond to continue the experiments with a slower type, with the result that the Hammond "house boat" was refitted for the radio tests.

RADIO DIRECTION FINDER.—The direction finder, as it is to-day, consists electrically of two main parts, the aerial circuits and the detecting circuits. The aerial system is made up of two closed oscillatory circuits which are insulated from each other throughout and also from earth. Each of these oscillatory circuits consists of an aerial loop, in series with which are inserted a coil of wire and a condenser; the condenser is inserted in the middle of the coil of wire, for symmetry. The two aerial loops, which are of equal size, are suspended in vertical planes crossing each other at right angles. The two coils of wire are also of equal size and also cross each other at right angles in vertical planes. They are contained in a box, together with their respective condensers, which are made variable for the purpose of tuning the aerial circuit to various waves. One hondle varies the two condensers, simultaneously. Inside the crossed coils, a third coil called the exploring coil is mounted on a vertical spindle by means of which it can be set at various angles with reference to the fixed coils. The detecting system consists of a pair of telephones, and a crystal of carborundum, in a series with a potentiometer and battery, which are required to bring the carborundum into a sensitive condition. The detecting system is contained in a separate box, and is connected by wires to the exploring coil, which picks up the signals from the aerial circuits and hands them on to the detector, where they are rendered audible in the telephone.

Each aerial loop is a directional aerial which receives best when its plane is in the direction of the sending station. If its plane is at right angles to the direction from which the signals are coming, it receives nothing. In intermediate positions it receives signals, the induced current due to which varies as the cosine of the angle between the plane of the aerial loop and the direction of the sending station. Except in the case when one of the aerials is in a plane exactly at right angles to the direction from which signals are coming, currents are induced in both the aerials, their relative strength depending on the direction of the sending station with reference to the planes of the two aerial loops. These currents pass through the corresponding crossed coils in the direction finding instrument, and produce in the space enclosed

by them two magnetic fields at right angles to each other. The two fields, whose relative strength depends on the relative strength of the currents induced in two aerials, combine to form a resultant field at right angles to the direction from which signals are coming. The exploring coil will consequently receive the strongest signals when its plane is at right angles to that of the resultant field; or in other words, when its plane is in the direction from which signals are coming. A pointer attached to the spindle on which the exploring coil is mounted indicates the position of the latter, and consequently the direction of the sending station. It has been assumed that the crossed coils are in the same planes as the crossed aerials. If the instrument is moved from this position the positions on the scale which represent the crossed aerials remain the same, so the pointer indicates correctly with reference to them.

The testing instrument consists of an oscillatory circuit composed of a condenser and a coil of wire, the wave length of which can be adjusted by a switch to either 600 or 300 meters. This oscillatory circuit is excited by means of a buzzer and battery which are switched on by the same switch that sets the wave length. The aerial connecting wires are taken past the coil of the testing circuit at equal distances, so that the two aerials are



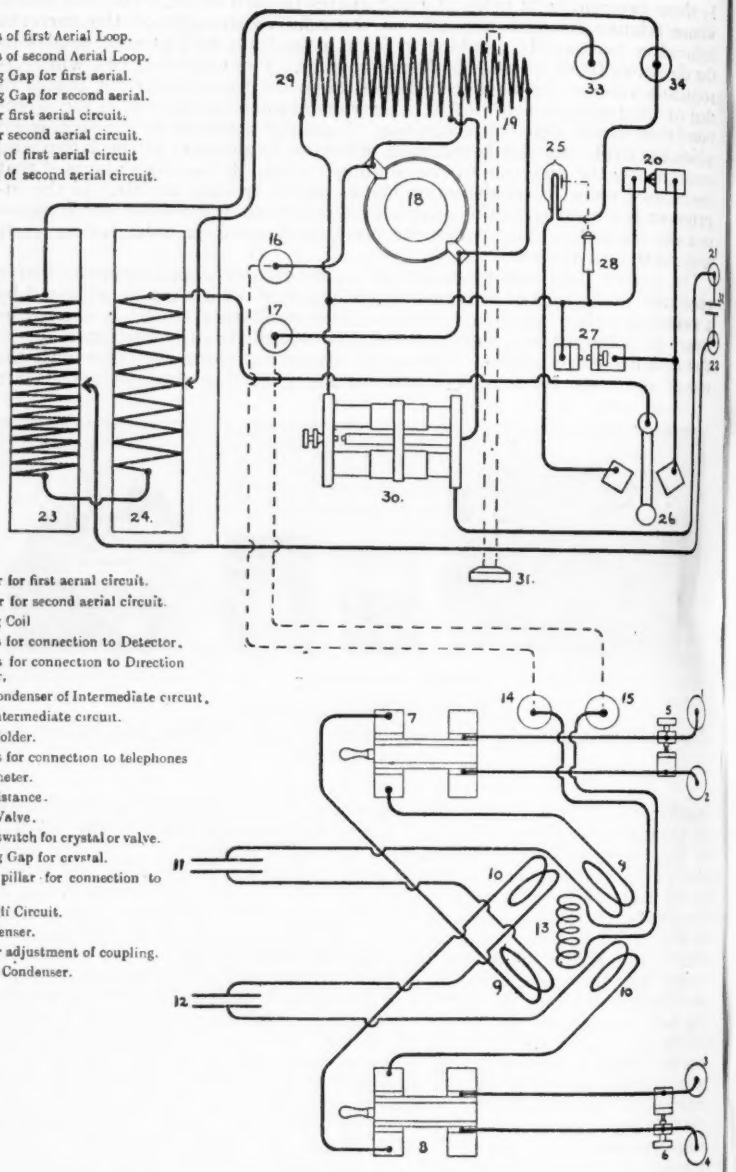
PARTS OF RADIO MACHINE

From left to right, the radio-goniometer, angle divider, test buzzer and tuned receiver

equally excited by it. If the aerials are in every way identical, as they should be, the direction finder will show a direction corresponding to the position of the testing coil with reference to the aerial connections. This is ordinarily arranged to give a direction along the course of the ship, which is 0° on the scale of the direction finder. If there is a bad connection in one of the aerials, the introduction of the resistance due to it reduces the current in that aerial and consequently alters the direction shown by the direction finder; and if the insulation between two ends of one of the aerials becomes bad, the same effect is found. When one of the aerials becomes earthed, the phase of the current in it is altered, with the result that a rotating field is produced in the direction finder, and no point can be found in which there is no sound in the telephone. The type of buzzer employed is one in which a non-inductive shunt is connected across the magnet coils, with a view to reducing the sparking at the contacts and consequently making the interruption as sudden as possible. The current which works the buzzer is passed through the coil of the testing circuits, and the electromagnetic energy so stored is released by the sudden interruption of the current which discharges itself into the condenser, and sets up oscillations in the circuit.

The exact position of the aerials naturally differs on each ship, and is mainly a matter of convenience. Deviation, owing to the ironwork of the vessel, is practically non-existent, unless the conditions are quite excep-

1, 2. Terminals of first Aerial Loop.
3, 4. Terminals of second Aerial Loop.
5. Protecting Gap for first aerial.
6. Protecting Gap for second aerial.
7 Switch for first aerial circuit.
8. Switch for second aerial circuit.
9. Fixed coil of first aerial circuit
10. Fixed coil of second aerial circuit.



11. Condenser for first aerial circuit.
12. Condenser for second aerial circuit.
13. Exploring Coil
14, 15. Terminals for connection to Detector.
16, 17 Terminals for connection to Direction Finder.
18 Tuning Condenser of Intermediate circuit.
19 Coil for intermediate circuit.
20 Crystal Holder.
21, 22. Terminals for connection to telephones
23 Potentiometer.
24. Series resistance.
25. Fleming Valve.
26. Two way switch for crystal or valve.
27. Protecting Gap for crystal.
28. Terminal pillar for connection to valve
29 Coil of Billi Circuit.
30 Billi Condenser.
31 Handle for adjustment of coupling.
32 Telephone Condenser.

CONNECTIONS OF DIRECTION FINDER WITH TUNED RECEIVER

tionally unfavorable. If it exists it is a constant factor that can be allowed for. It is generally convenient that the instruments should be in the wireless cabin, chiefly for silence, and in order to be in touch with the ordinary installation for calling up shore stations, or to disconnect the direction finder, and so protect it before transmitting on the ordinary aerial. But it can equally well be installed in the chart house, or any other position convenient for a navigating officer, which is connected with the wireless cabin by telephone.

Whatever position be fixed upon, the wires from the aerial system are led directly to the radio-goniometer box, which contains two very accurately paired air condensers with an adjusting handle and the radio-goniometer proper. One condenser is inserted in the circuit of each aerial and both aerials are thus tuned simultaneously. When the instruments have been adjusted to any arriving wave, its direction, or rather the plane of its direction, is indicated directly by turning the index handle of the radio-goniometer till the position of exact signals is found. The accuracy with which the direction can be determined depends almost entirely upon the care with which the observations are taken, as the error due to the instrument does not exceed one degree. Any error in laying out the aerials will appear in the result, because they are the base line with respect to which the observations are made. Under ordinary conditions, however, bearings can be taken within two or three degrees and the error should never exceed five degrees.—*The Wireless Age.*

STATIONS FOR RADIO FOG SIGNALS.—It is reported that the north coast of France will shortly be equipped with small radio stations for the purpose of enabling ships to ascertain their positions in foggy weather. To this end (1) there must be a sufficient number of such stations, (2) the ship must be within the working radius of two stations, and (3) the ship must be equipped with a special receiving apparatus. Lighthouses and other high points are first to be equipped as stations for this service. The cost of building and equipping stations is comparatively small; attendants are not necessary for the sending of signals. Two stations erected on islets NW. and SW. of Brest are already in service and are working in a satisfactory manner. By means of an automatic contact maker they send out at regular intervals two different numbers, one of which occurs every 10 seconds and the other every half minute. In the future every such station is to send out a signal distinctive of its source. A few ships are already equipped with the necessary receiving apparatus. The next port to be equipped will be Havre. These radio stations have a working radius limited to the regions adjacent to the coast, in order that they may not interfere with general radio communication.—*Marine Rundschau.*

AVIATION

DIRIGIBLES FOR THE U. S. NAVY.—An aeroplane for every battleship in the navy, dirigibles in a much smaller number, and the concentration of naval aeronautical work in Pensacola, Fla., are among the recommendations made to the Navy Department by the board of naval officers appointed to draw up a plan for the organization of an adequate American naval aeronautical service. The board that after a long series of consultations finally submitted its finding to the Secretary of the Navy is composed of Captain Washington I. Chambers, President, and Commanders C. B. Brittain and S. S. Robison, Lieutenants M. H. Simons and John H. Towers, Naval Constructor H. C. Richardson, and First Lieutenant Alfred A. Cunningham of the marine corps.

The board points out that, while aeroplanes are now recognized as an important part of the equipment of all modern navies, their capabilities are limited in many ways which makes necessary the consideration of the

dirigible for uses for which the aeroplane is as yet unfitted. Foreign nations are already making use of the naval dirigible, and it is now the duty of the Navy Department to study the question of dirigibles and decide upon the place they are to have in the United States fleets, the report says. The purchase of dirigibles at an early date is therefore one of the recommendations.

Likewise the board recommends the construction of sheds for the dirigibles, the purchase of hydrogen plants and all other appliances necessary in the handling of dirigibles, and the development of auxiliary ships for their operation with the fleet for advanced base purposes.

As to aeroplanes, the board believes that this type of flying machine should eventually be placed on board of every fighting ship of the first class in the navy, and also any groups of other ships engaged in scouting duty or on detached service. The fleet auxiliaries should carry the supplies, stores, and extra parts for the aeroplanes, the purpose being not to incumber to any greater extent the fighting units of the fleets. Eventually, in the opinion of the board, special ships for aeroplanes and other types of flying machines should be considered, although this recommendation is not for immediate consideration.

Pensacola is recommended as the naval aviation center because of natural advantages, such as its splendid harbor, its climate, which is peculiarly fitted to aeronautical work and its importance as a railroad center. A station ship for Pensacola is also suggested, the ship to be used as a "flying school" for the qualification of aviators in advanced aerial work, and also for the testing of materials, such as devices for the launching of aeroplanes from ships and methods of hoisting and stowing them on board.

An office of naval aeronautics is also suggested, and the board considers such a bureau absolutely essential to harmonious and rapid progress in the development of the aerial arm of the service afloat. The board also recommends the location of the aeronautic laboratory at the Washington, D. C. navy yard.

The report is understood to meet in general the approval of Secretary of the Navy Daniels.

DIRIGIBLE AND AEROPLANE FLEETS OF THE LEADING NATIONS.—It is difficult to obtain at any given time a complete statement of the strength of the various nations in aircraft. The most reliable estimate is that issued for public information by the office of Naval Intelligence of our navy, which is herewith presented. It will be seen that the United States ranks far below the leading nations in military aircraft. Our one small dirigible is regarded as "practically useless."

ARMORED AEROPLANES IN FRANCE.—It appears that the German War Department took the lead in protecting aeroplanes by armor plating, and after this the idea was taken up in France, where several armored flyers were to be seen at the last Paris show. However, the French Army did not go extensively into the matter before attention was called to it by two events, one being the experiments made at the Toulon arsenal in firing upon aeroplanes last year, and the second the results of the first war in the Balkans. It was then recognized that all aeroplanes were vulnerable when flying below 4000 feet, and with the present system of observing, a machine needs to fly as low as 2000 to 2500 feet in order to see the state of affairs on the ground. It would thus be exposed to artillery and infantry fire. Two solutions were presented for protecting aeroplanes, first to armor plate for the men, motor and devices, or only to protect the aeroplane guns and in this case keep the flight very high so as to prevent being hit. Here the observer would lie at full length and observe by sets of lenses. The French Army decided to adopt the first solution, that is, good protection and low flight, and from now on all the combat units will be armored. As to

the unprotected ones, these will serve for training of pilots. The experiments which are to be made with new armored aeroplanes will be kept quite secret. It is surmised that the future aerial fleet will be made up of the following types of aeroplane: First, armored single-place flyers for artillery and cavalry scouting and for short scouting trips at the speed of 70 miles an hour. Second, the Etat-Major will make use of two-place scouting aeroplanes, also armored, and used for 60 miles an hour speeds. The third kind is an armored two-place with mitrailleuses and automatic guns, intended for pursuing the enemy's aeroplanes and airships and working at the speed of 70 miles an hour. Lastly, several-place types of heavy weight for a great range of flight and speed of 60 miles an hour, designed for special work.—*Scientific American.*

STRENGTH OF THE LEADING NATIONS IN AIRCRAFT

	Military Dirigibles	Private Dirigibles (Estimated)	Military Aeroplanes (Includes Monoplanes, Biplanes, Hydroaeroplanes)		Private Aeroplanes (Estimated)	Aviation Fields	Pilots (Military and Civilian)	Manufacturers
			Army	*Navy*				
Austria:								
On hand	5	2	40	6	35	.....	.....	.....
Ordered	3	.....	.....		.....	3	60	5
England:								
On hand	3	3	101	40	154	.....	.....	.....
Ordered	4	.....	47	20	.....	31	382	21
France:								
On hand	13	5	450		1,000	.....	.....	.....
Ordered	7	.....	.....		.....	39	1,200	20
Germany:								
On hand	17	10	152		200	.....	.....	.....
Ordered	5	.....	.....		.....	36	320	15
Italy:								
On hand	8	0	100		100	.....	.....	.....
Ordered	2	.....	30		.....	14	200	.....
Japan:								
On hand	2	0	20		5	.....	.....	.....
Ordered	1	.....	.....		.....	3	20	.....
Russia:								
On hand	9	0	250		150	.....	.....	.....
Ordered	10	.....	0		.....	8	118	.....
United States:								
On hand	(1)	0	20	5	1,000	.....	.....	.....
Ordered	.....	.....	3	1	.....	13	320	 6

[1] One dirigible, which is practically useless, is on hand.

FRANCO-GERMAN AERONAUTICAL CONVENTION.—The difficulties which have occasionally arisen between France and Germany owing to the voluntary or involuntary landing of aircraft belonging to one nation on the territory of the other, have led to the drawing up of an aeronautical convention between the two countries, the provisions of which seem somewhat stringent. The principal are as follows: Airships or aeroplanes arriving in France (or Germany) which belong to the military administration of the country from which they have sailed, or are manned by military men in uniform, are not permitted to fly above French (or German) territory except on the invitation, or with the permission, of the respective governments. If an airship or an aeroplane is obliged to descend owing to circumstances

beyond the control of the pilots, an alarm signal is to be sounded, and the descent made as soon as possible. The military authorities, on being advised, are at once to institute an inquiry, the sole object of which will be to ascertain if it was really a case in which landing was absolutely unavoidable. Pilots and passengers are required to submit themselves to interrogation by this court of inquiry, and the court is to cause the necessary supervision to be exercised, to ensure that no alteration, modification, or destruction of objects or documents carried by the vessel or any of its occupants is permitted. If it is not satisfactorily shown that the landing was unavoidable, the military authorities are to notify the government, and the matter will be dealt with by the judicial authority. Both countries agree to notify each other the distinctive marks of the craft belonging to the respective military administrations. These distinctive marks are to be visible at a long distance while in flight. Similar arrangements, though somewhat less severe, have been adopted in regard to private airships and aeroplanes, with their pilots and passengers.

THE FRENCH ZEPPELIN.—The French airship *Spiess,* built on the lines of the German Zeppelins, has completed its trials, and has been taken over by the authorities. It differs from the German pattern in that the framework is of wood instead of aluminium. The airship is 377 feet long and 43 feet in diameter, with a capacity of 600,000 cubit feet; it is divided into nine large and five small gas chambers. It has two cars, and is propelled by two Chenus engines of 175 horse-power, each driving two screws 13 feet in diameter. Compared to the great German airships, the *Spiess* seems to be a small and somewhat under-engined craft, and it is to be anticipated that she will prove slower and less airworthy than the German model, and equally subject to damage in landing. Four non-rigid dirigibles are to be completed by December 1, and four more have been ordered. These are larger than the *Spiess* Zeppelin, having a capacity of 812,000 cubic feet, and more powerfully engined, the total engine power being 1200 horse-power from nine motors, of which there are three in each of the three cars.

FIRING FROM AN AEROPLANE.—Some interesting experiments were carried out at Bisley on November 27 by the Birmingham Small Arms Company with the Lewis air-cooled machine gun, which weighs only 26½ pounds, and which was fired from a 50-horse-power Grahame-White biplane of somewhat ancient type, and which proved the possibility of firing a rapid succession of shots from an aeroplane in flight, and of hitting a 30-foot target from a height of 500 feet in 11 out of 14 shots.—*Journal of Royal Naval Service Institute.*

BOMB DROPPING.—At Epinal, experiments in bomb dropping from aircraft were carried out recently, from heights varying between 300 and 4500 feet, at targets which were plainly visibly, as also against targets which suddenly appeared. Photographs were taken of the results; these are not, of course, published. At the same place firing was conducted from aircraft against air targets, and firing being from a 5-cm. gun and new projectiles of special pattern being used. Practice was made against a captive balloon moored some 7500 yards distant, and which was moved from time to time so as to necessitate change of elevation, etc. Then followed practice against free balloons moving at varying wind strengths.

It is also stated that at Chalons sur Marne at the end of September experiments were carried out from an armored aircraft mounting a large caliber gun in a small revolving turret. The craft is described as very speedy and intended specially for the attack on Zeppelins.—*Journal of Royal Naval Service Institute.*

RADIO EXPERIMENTS.—From a Bréguet aeroplane to a ground station at Douai, France, there were recently made very satisfactory wireless experiments. The aeroplane is a three-seated flyer designed for the government of Siam. The aeroplane kept on its flight from the aerodrome and sent messages every five minutes to a land station in the town of Douai. The musical wave method was employed, and it is said messages could be heard with the aeroplane as far as sixty miles off, in spite of the small power used in the apparatus on board.—*Army and Navy Journal.*

LESSONS OF THE "L. II" DISASTER.—The appalling disaster by which not only the *L. II*, the latest and largest of the Zeppelin dirigibles, was reduced to a charred wreck, but twenty-eight human beings also suffered instant annihilation, should serve to remind us how little we yet know of the proper method of construction of airships, how limited is the practical knowledge of the experts in such matters, and how futile has been the widely trumpeted claim of man to have achieved the conquest of the air.

The *L. II* was undoubtedly the finest and most formidable airship ever constructed. She was 520 feet in length, with a maximum diameter of 56 feet, and a cubic capacity of 960,000 feet, and specially designed to include in her construction, such improvements as the various accidents to previously built vessels of the rigid type may have suggested. Moreover, so fully had the vessel satisfied every test imposed by the Admiralty before receiving her into the service that she was to have been taken over by the Naval Department on October 8, the day following the date of the disaster.

The official account of the airship disaster was given at the time as follows:

"The naval airship was making a trial voyage. She started this morning for a high flight, with twenty-eight persons on board. After three minutes she had attained a height of 200 meters (over 600 feet), when flames burst forth between the fore engine-car and the envelope. In two or three seconds the whole ship was on fire and an explosion occurred. At the same time the airship fell slowly head downwards, until she was 40 meters (130 feet) from the earth. Here a second explosion took place, presumably of benzine. When the vessel struck the earth a third explosion occurred, and the framework collapsed. A company of pioneers and guide-rope men hastened to the scene, and doctors were immediately in attendance. Two of the crew were picked up outside the ship still alive, but they died shortly afterwards. Lieutenant Bleuel, who was severely injured, was taken to hospital. The remaining twenty-five of the crew had been killed during the fall of the airship or by the impact with the earth. The cause of the disaster appears to have been, so far as is at present known, an outbreak of fire in or over the fore engine-car."

Presumably the German Admiralty and the Zeppelin officials are the only persons who were at all acquainted with the details of the internal arrangements, and the report of the official investigation of the origin of the disaster, quoted by the *Times* correspondent in Berlin on October 29, as appearing in the *North German Gazette*, gives the following conclusions:

"First, the creation of a vacuum in the forward car as the result of the new sort of screen at the front of the car; secondly, suction of the gas flowing out on the under side of the airship; thirdly, ignition by a spark from the motor of the gas mixture sucked into the car. The possibility of such a disastrous process of suction in connection with this new sort of screen had been foreseen neither by the navy constructors nor by the Zeppelin Company's constructors. The previous screen construction had been thoroughly satisfactory.

"It is denied that there is any ground for the belief that a defect in the motor was detected before the ascent, and it is said to have been proved that the motors were working perfectly." The *communiqué* proceeds:

"'It has further been stated that the Zeppelin Company, and especially the late Captain Glund, entertained the gravest misgivings regarding the

construction of the airship, which is supposed to have been required by the naval authorities, and especially regarding the putting of the gangway inside the ship. According to an explicit declaration of the Zeppelin Company this is not the case. The alteration by which the gangway was put into the body of the ship was first suggested by the Zeppelin Company. Misgivings on the part of the company are also absolutely impossible, because the company, which by contract determined the construction and was responsible for it, would otherwise, as a matter of course, neither have carried out the private trials nor have exhibited the ship to the naval authorities on the cruise from Friedrichshafen to Johannisthal with Captain Glund in command, nor have allowed Captain Glund and his engineers to take part in the further trials as representatives of the company.

"'This declaration, which was made in the name of the Zeppelin Company as well as of the navy, disposes of all rumors and fictions. The now recognized sources of danger will in future be eliminated. As to the course to be taken to this end there is complete agreement between the navy and the Zeppelin Company.'"

AIRSHIP FOR ENGLAND.—The English Government is negotiating the purchase of an Italian airship of the Forlanini type, which is of semi-rigid construction. Apparently the construction of such a ship about 70 m. in length has been begun for the English Government. Its speed should be about 45 knots.

AVIATION EXPENDITURES IN FRANCE.—The expenditures on account of aviation in France amount to 5 millions of marks, and may be itemized as follows:

1. Purchase of 208 flying machines and airships, 1.8 million marks. 2 Sixty-nine flying stations, 1.5 million marks—each station comprises about 10 hectares of land and a shed about 20 meters long and 20 meters broad, equipped with telephone and quarters for the guard. 3. Instruction of aviators, 330,000 marks. A total of 75 flyers have been instructed, of whom 67 hold the Aero Club certificate while 39 also hold a military.

AVIATION IN ITALY.—The Forlanini airship *Città di Milano* has finally been tested and turned over to the military authorities. This airship combines in itself the advantages of both the rigid and non-rigid types. It is 72 meters long, 18 meters wide and has two motors; the diameter of the propeller is 5.7 meters. The ship is operated entirely from a gondola at the forward end.

RUSSIAN MILITARY AERONAUTICS.—It is reported that a new airship which is being built in the Baltic shipyards for the Russian air fleet will be twice the size of the largest existing airship which Russia possesses (*Astra No. 13*, which was built in France) and will, in external construction, resemble no other modern airship. It is to be housed in a specially constructed building to be erected near St. Petersburg and will be named the *Gigant*. Besides the above, Russia possesses four air cruisers of the first rank—*Parseval, Astra, Condor* (formerly the *Clement-Bayard No. 17*), and *Albatross*. These are maintained in the frontier military districts. The aeroplane organization consists of three flying companies—No. 1 in St. Petersburg, No. 2 in Sebastopol, and No. 3 in Kieff. Each company supplies the necessary flying personnel and material for the corresponding military districts: St. Petersburg, Odessa and Kieff, and the army corps stationed therein. Detachments are also at the disposal of the various fortresses. No difficulty is experienced in officering and manning the growing air fleet, the numbers attending the various schools for training in navigation and observation increasing yearly. It is expected that another company will be formed at Moscow shortly, arrangement having been taken in hand with a view to establishing a permanent flying ground. It is also contemplated to start a

branch of the Gnome engine factory in order that Russia may be independent of foreign aid so far as motor engines are concerned. Another proof of Russian advance in aeronautical matters is the attention which is being given to the newest discoveries in the way of aeroplane accessories, such as the dictaphone, illuminating rockets, etc.—*United Service Gazette.*

A new seaplane is being built for the British Admiralty by the Sopwith Company, which it is claimed, will show a very considerable advance on any flying machine at present possessed by the naval service. It is of quite unusual dimensions, the measurement from tip to tip of the wings being 80 feet. The other parts are on a similarly generous scale, the special aim of the designer being to enable it to carry a wireless installation with the widest possible range and a quick-firing gun. It will thus have seating accommodation for three men—a pilot, a wireless operator, and a gunner. The gun is placed in the front part of the seaplane, and the pilot and wireless operator behind. There are two 120 horse-power Austro-Daimler engines, giving 240 horse-power, and a special auxiliary engine will be carried to drive the wireless apparatus. It is expected that the new seaplane will be ready to undergo the Admiralty tests about January 1, 1914.—*United Service Gazette.*

SOME RESULTS OF PARIS SHOW.—Among other orders which had been placed at the end of the first week of the Paris show were those for three 130 horse-power Breguet seaplanes, with the new rigid wings, by the Italian Navy, for six 70 horse-power Bathiat-Sanchez biplanes by the Chilian Government, for several 100 horse-power Deperdussin hydromonoplanes for the Japanese Navy, while the French Army has purchased the interesting biplane with variable angle planes designed and built by M. Paul Schmitt.—*Army and Navy Gazette.*

NEW WRIGHT AEROBOAT.—The new Wright aeroboat which was announced some time ago and which has been eagerly expected by the aviation world, made its first appearance recently on the Miami River, near Dayton. Under the expert hands of Orville Wright, who has been flying the craft, it showed higher efficiency and stability than has previously been attained with this type of craft.

With only a 60 horse-power engine, the aeroboat demonstrated its ability to lift three or four persons and showed a speed of very nearly 60 miles an hour. In numerous flights up and down the river, both in winds and calm, the new aeroboat surprised spectators by the ease with which it rose from the water in a run of only a few hundred feet.

The hull of the new craft is made of metal and contains the engine and seats for the passengers. Contrary to former practice, the engine is placed low and the seats high, both being much better protected from spray and waves in this manner.

To lift two persons at a speed of about 60 miles an hour it has been necessary during the past season to equip these boat-like flying machines with engines of almost 100 horse-power, and a considerable advance has been attained in the development of the aeroboat by the new Wright type in that the power required to accomplish the same result is practically halved. This is due entirely to various novel features in the design and construction of the boat hull and the aeroplane wings.

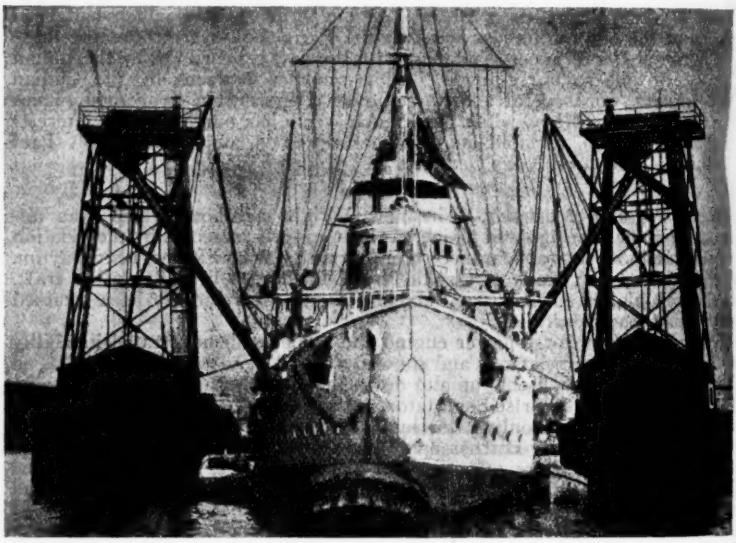
A convenient starting crank is fitted back of the seat, and the craft flown by Mr. Wright, equipped with anchor, whistle, lights, and other paraphernalia shows the tendency in these craft more and more to approach standard boat lines. Experts predict that next season aeroboats will gain tremendous popularity and that a new sport has been founded which will greatly awaken interest in aviation throughout the country.—*Army and Navy Register.*

THE NEW ITALIAN AIRSHIP.—Very much like the Veeh airship recently described in these columns, is the new *Citta di Milano*, designed by Forlanini. She is 236 feet long and 59 feet broad. She has two motors of 100 horse-power each, capable of driving her at a speed of 45 miles an hour. Her propellers have a diameter of 13.7 feet and a speed of 260 revolutions per minute. The car is made to adhere to the envelope instead of being suspended by the usual rigging.—*Scientific American.*

"M 3."—The new Italian airship *M 3*, which is being fitted out in the military aviation park at Vigna di Valle, near Rome, has already been inflated with a volume of 12,000 cubic meters (423,777 cubic feet) of hydrogen. The bag has therefore the same capacity as those of the other airships of the *M* (= medium) class. It is divided into twelve independent compartments, and the car will in this case be attached close up against it to reduce the air resistance. The vessel will have four motors with eight cylinders each.—*The Engineer.*

ENGINEERING

NEW METHOD OF COALING.—The difficulty in getting reliable labor in the West Indies in the matter of coaling vessels forced the Havana Coal Company at Havana, Cuba, into adopting some means whereby they could rid themselves of this nuisance. How that company solved this problem is shown in the illustration on this page, where two of its barges are bunkering the H. M. S. *Melpomene*. These coaling barges were equipped by the Link-Belt Company of Philadelphia to handle run-of-mine coal at the rate of 125 to 150 tons per hour for each barge. The arrangement in each case includes two strong apron conveyers running the entire length of the barge under the storage space, receiving coal through Link-Belt undercut gates and delivering it to a Link-Belt gravity discharge elevator which runs to



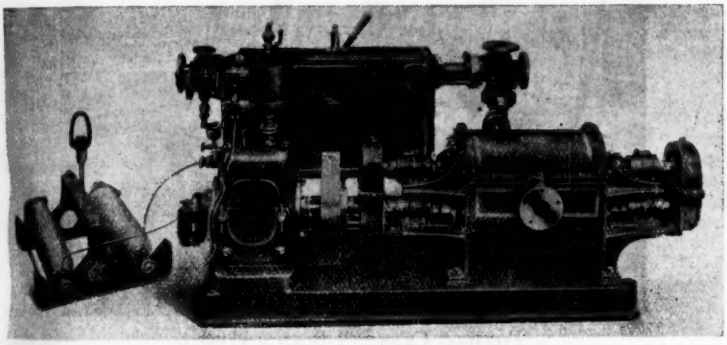
TWO OF THE NAVAL COAL COMPANY'S BARGES EQUIPPED WITH LINK-BELT COALING APPARATUS BUNKERING H. M. S. "MELPOMENE"

a sufficient height to secure a proper angle of flow through a swivel spout leading to the different bunkers of the ship as desired.

The barges take their coal at the docks in relatively shallow water and deliver it to deep-draft vessels anchored in the harbor. The efficiency and economy of this system is attracting considerable attention among coaling companies throughout the world.—*Marine Journal.*

THE HALLEY FIRE-EXTINGUISHING APPARATUS.—The recent disastrous fire on board the S. S. *Volturno* while in mid-Atlantic has forcibly directed public attention to the problems of fire extinguishing at sea, and particulars of the Halley fire-extinguishing, disinfecting and fumigating system will, therefore, be read with interest, especially as the apparatus is now being placed on the British market, after having been extensively adopted in the Dutch mercantile marine. The Halley method adopts the system of bringing sulphur dioxide (SO_2) into the holds, bunkers, or other compartments in sufficient quantities to extinguish an outbreak of fire, or to fumigate or disinfect as may be required. If the air in the compartment to be dealt with is mixed with about 10 per cent of the gas named, the usual process of combustion cannot take place, and even such inflammable materials as burning benzine would be extinguished.

The apparatus, situated in a convenient central station on board the vessel, say on the boat-deck, consists of a small engine-driven blower (steam, petrol



HALLEY FIRE-EXTINGUISHING APPARATUS

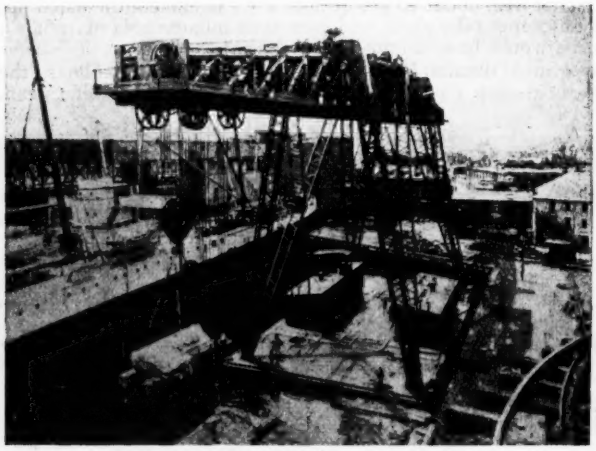
or paraffin may be employed) coupled to a gasifier. The sulphur dioxide, which is carried on the vessel in liquid form in steel bottles, is admitted to the gasifier and there mixed with hot air drawn from the compartment where the fire exists, or, for fumigating purposes, with exhaust or live steam from the blower engine. The blower then forces the mixture of SO_2 and air into the hold or other compartment affected through permanently fitted pipes leading to all compartments, draws it back again to the gasifier, and again ejects it into the hold, thus keeping up a continual circuit and enabling the percentage of SO_2 to be maintained at any desired value. The figure illustrates the standard type 12 M^3 steam-driven gear, showing two 1-cwt. steel bottles of SO_2 ready for use.

A demonstration of the Halley apparatus was recently given on board the new steamer *Radja* in Queen's Dock, Glasgow. A hold with a capacity of about 20,000 cubic feet was used for the experiment, and a percentage of gas of five was obtained after 15 minutes, and after 1½ hours, just before the hold was unsealed, 10 per cent was registered. It was found that the naphtha lights had been extinguished and the rats placed in the hold were

dead, while the bananas, grain, tobacco, gilded ornaments, silks, etc., were uninjured. Owing to leaks developing in the hold and to the use of a small temporary boiler which hardly gave sufficient steam, it was found difficult to maintain the percentage of gas in the hold, and consequently the test was not so successful as anticipated, but the efficiency of the gear was nevertheless fully demonstrated.

The Halley apparatus is being worked in this country by the Welin Davit & Engineering Co., of Lloyd's Avenue, London.—*Shipbuilding.*

ELECTRICALLY OPERATED PONTOON CRANES.—Two 150-ton pontoon cranes have recently been built by the Wellman-Seaver-Morgan Company for the United States Navy Department. One of these large electrically driven hoists is to be placed in the Boston harbor and the other in Pearl harbor, Honolulu. Both will be used for transferring freight to lighters and for erecting or removing turrets, guns, boilers and other machinery or apparatus used on battleships.



PONTOON CRANE IN BOSTON HARBOR

In order to test the accuracy of the control equipment in landing a load, a heavy weight was lowered by the crane to strike a block laid on top of an empty oil can. It was found possible to stop the load without injuring the oil can or deforming it. In order further to test this point, the weight was suspended about 2 inches above the block and then lowered to see how close it could be brought to that object without touching it. The distance was found to be 0.0625 inch.

The controllers for both cranes are of the magnetic type and were furnished by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.—*Electrical World.*

OIL ENGINES FOR THE NAVY.—Lieutenant F. X. Gygax, U. S. Navy, who has been on duty in Switzerland superintending the construction of Diesel engines for submarine boat *G 3*, returned to this country last week and has reported for duty in the Bureau of Steam Engineering of the Navy Department. These engines were constructed for the Lake Torpedo Boat Company, but as the contract has been taken over by the government, the engines will be shipped to this country and installed at the New York navy yard.

Lieutenant Gygax is understood to have acquired much valuable information regarding the Diesel engines during his tour of duty abroad. Work has begun on the construction of the experimental oil engines intended for installation on the naval collier *Maumee* at the New York navy yard. Much discussion has been prevailing among the naval engineers as to the scope of the internal-combustion engine. The most conservative naval view is that it will be limited to small craft, notably in the submarines, where oil propulsion is almost universal. Information received at the Navy Department indicates that the foreigners have encountered much trouble with the Diesel motors. One reason is the high speed of these, most of them from 350 to 450 revolutions per minute. The piston speed has to be as much as 1000 feet a minute, as against 600 feet a minute in the mercantile type. Hence the time available for the dissipation of the heat by the jacket water is very small, the difficulty of cooling the piston effectively therefore being greater than in the ordinary type of motor. The result may be a crack, which is a serious matter, since the fuel charge may enter the crank chamber and cause explosions. In this way accidents have happened on several occasions. The experienced gained on merchant vessels propelled by oil has helped towards the solution of the naval problem, because even in their engines cracked cylinder covers occur. Both in design and material, however, improvement is taking place as engineers adapt the oil motor to marine conditions. Curiously enough, accidents have been more frequent in French submarines than in those of any other country. But since the cast-steel piston has been replaced by one of cast iron the trouble has been largely overcome. Unlike other navies, too, the French Navy has many submarines driven by steam. Apparently that government has decided not to place entire confidence in the Diesel motor.

OIL CONSUMPTION.—The total oil consumption of the British Navy for the past year amounted to about 200,000 tons. England is to build a fleet of 13 tank steamers, among them larger ships for the oversea transport of oil, and smaller ones for the distribution of oil to the fleets and flotillas. All 13 tank steamers will probably be ready for service by the end of 1914. The five largest ships have a greater oil-carrying capacity than would have been necessary to supply the navy during the past year.

IMPROVED BATTLESHIP MACHINERY.—The Navy Department has concluded contracts with the Westinghouse Machine Company for reduction gears, a mechanical device invented by the late Rear Admiral George W. Melville, J. H. MacAlpine and George Westinghouse, for installation in the machinery of the battleship *Pennsylvania*, repair ship *Melville*, and battleship (unnamed) *No. 39*. The object of the reduction gear is to reconcile the high speed of the power machinery of the ship with the slower speed of the propeller, thereby obtaining the greatest efficiency from the marine equipment. This is therefore considered one of the most important inventions in marine engineering construction, and by its adoption in the above-named vessels the U. S. Navy assumes the lead in modern methods of marine propulsion.—*Marine Journal.*

A NEW STEAM TURBINE.—The Italian Ministry of Marine has been conducting in the harbor of Spezia trials of a new steam turbine and satisfactory results are reported. The new turbine is the invention of Professor Belluzzo of the Milan Polytechnic College and is claimed to have the following advantages: Lower steam consumption at all speeds, particularly at cruising speeds; strong construction, and easy operation.—*Marine Rundschau.*

H. M. S. *Linnet*, late Havock, built for the British Admiralty by Yarrow & Co., Limited, of Glasgow, has very successfully completed a series of speed trials. Particular interest is centered in this vessel, owing to the

fact that she is fitted with the latest type of Yarrow boiler, with special superheaters and feed heaters, which have, we are informed, resulted in a very high economy of fuel being obtained on the trials, especially at cruising speeds. There appears to be little doubt that owing to the great advantage derived from superheating its adoption will become general for naval vessels in the early future.—*The Engineer.*

MISCELLANEOUS

PERSONNEL PROBLEM OF GERMANY AND OF ENGLAND.—Germany has now set up a new standard in order to obtain the fullest fighting value of her matériel at practically a moment's notice. To her personnel is cheap, while to England it is dear, so instead of embarking upon a further great expansion of her shipbuilding program, she is determined to keep ever ready for action practically every efficient ship which she possesses. Fifteen years ago she had only 25,000 officers and men, but, as rapidly as the machinery for training will permit, the numbers are being added to annually, and in 1920 she will have 107,000 officers and men available. Day by day, week in and week out, this work of training is being carried on. This is the feature of German naval legislation, which is really important, and yet in current discussions in the non-technical press there is still a continual harping upon dreadnoughts. We can only hope that when Mr. Churchill comes to present his estimates to Parliament he will take some pains to explain once more the dangers which lurk in the steady progress of the German fleet.

SUNDRIES.—During the year 1913 20 vessels of the dreadnought type were passed into service as compared with 18 in 1912, raising the total to 68. Of the 20 vessels completed, Great Britain (including Australia) and Germany each accounted for 5, France and Italy for 2, the United States, Japan, Austria and Spain for 1. The vessels completing the total are the Argentine battleships *Moreno* and *Rivadavia.*

The number of dreadnoughts launched during the year was 22, as compared with 17 in 1912, 27 in 1911, and 9 in 1910. The Japanese battle cruiser *Kirishima*, launched on December 1, was the 100th dreadnought to go afloat, the *Haruna* (December 14) being the 101st, and the *Tiger* (December 15) the 102d. There are thus 34 ships of the type completing afloat, or exactly one-half of the number already in service. Of the 22 ships launched in 1913, 5 were launched for the British and 5 for the German fleets, 3 for the French, 2 for the Italian and the Japanese, and one each for the Russian, Spanish, Turkish, and Chilian navies. The 22d ship is the *Rio de Janeiro.*

It will be seen that Great Britain and Germany were numerically equal on the year's working, as regards both launches and completions. It is, therefore, of some interest to compare in the aggregate the vessels launched and completed on either side. The details upon which the following comparison is based are either official, or are taken from the otherwise most reliable sources:

	Launched		Completed	
	Britain	Germany	Britain	Germany
Number of ships	5	5	5	5
Total tonnage	133,000	135,725	115,200	121,850
Total armament:				
15-in.	16	—	—	—
13.5-in.	28	—	38	—
12-in.	—	46	8	40
11-in.	—	—	—	20
6-in.	68	66	—	68
Broadside from heavy guns (lb.)	69,700	45,126	59,050	46,840

Several of the aeroplanes exhibited at the Paris show this year were provided with apparatus for bomb-dropping. The most promising of these was the Coanda Patent gear attached to the Bristol biplane, in which twelve bombs lie centrally below the under main plane. They are held horizontally in a frame which is reminiscent of the cylinder of a revolver, but drop vertically when released. In order to allow for the curve of the trajectory which is due to the speed of the aeroplane, the bombs must, of course, be released at a considerable horizontal distance before the flying-machine passes over the target. For instance, with an aeroplane flying at sixty-five miles per hour at an altitude of 3000 feet, the horizontal equivalent for the curve must be about half the altitude in order to strike a stationary target. The Coanda aiming apparatus is designed to meet this necessity. The instrument comprises a series of prisms giving the position of the target, and by its aid the projectiles can be aimed at a warship at sea as well as at objects on land, while on electric lighting set provides for sighting on objects at night. As regards the bombs, they are quite harmless while lying in their rack, nor could they be exploded if the machine were to make a bad landing, and they were to get jarred or thrown from the rack when the undercarriage struck the ground. In order to become "live" they must be released at such a height above ground as to pass some distance through the air. The air-pressure during descent acting on a small propeller at the tail of the projectile, causes this propeller to revolve and thus uncoil a spring controlling the safety device, and this makes all ready inside the bomb for detonation on impact. The whole of the twelve bombs can be discharged in a space of time varying from twenty-one to thirty seconds, by either pushing a knob or employing an automatic catch. At the quicker rate the projectiles drop at intervals equivalent to horizontal distances of fifty feet.

By an ingenious arrangement of sights the pilot can see whether the aeroplane is in true line with the target, allowing for drift due to wind in the case of the flying-machine, or tide in the case of a warship. Then, while the prisms show him his altitude and the relative position of the target in the field of view, a small chart tells him how much time allowance to make for the curve of the trajectory when releasing the bombs. The method of dropping the latter can be further simplified by allowing an observer to look out for the right moment to let go the projectile. He, being responsible for any calculations, presses a button which shows a light to the pilot when the bomb should be dropped, and the latter merely effectuates the release, being otherwise only concerned with keeping the longitudinal direction in relation to the target.—*United Service Magazine.*

CUTTING METAL UNDER WATER.—A contemporary describes a new process for using the oxy-hydrogen torch under water for cutting metals, as in dismantling sunken ships. The torch is fitted with a bell-like head, which works in conjunction with a blast of compressed air. The system was recently tested in Kiel harbor in a depth of 5 m. of water, when an iron case of 100 mm. by 20 mm. was cut through, a cut of 10 cm. length being made within 30 seconds. A piece of iron 60 mm. square was cut through in the same time, while in a sheet 20 mm. thick a cut 30 cm. long was made in 1½ minutes. The pressure under which the oxy-hydrogen mixture of the cutting flames issues must be considerably increased, and the whole of the combustible gas must be consumed and not only a part, as is the case with the oxy-acetylene torch.—*Engineering.*

GOVERNMENT PROTECTS NAVAL SECRETS.—The United States Government has brought suit against the E. W. Bliss Company, which owns the patent for the Bliss-Leavitt torpedo in France, Japan and England. The company wishes to give the details of its system to Whitehead & Co., of England. The United States Government, insisting that it owns a proprietary interest in the torpedo, is seeking to prevent this disclosure.—*Scientific American.*

COMPARISON OF STRENGTH OF TRIPLE ALLIANCE AND TRIPLE ENTENTE.—Lieutenant General von Görz, in the *Preussische Kreuz Zeitung*, compares the peace strength of the Triple Alliance and the Triple Entente, of which the following is a *précis:*

Triple Alliance: Germany.—The German peace establishment should in 1915 amount to a total of 820,033 officers, non-commissioned officers and men.

Austria-Hungary has a total strength of 433,792. In the year 1916 or 1917 the total strength should amount to 510,000 officers, non-commissioned officers and men, in round numbers.

Italy.—For the European theater of war Italy has a total strength of 287,489. Shortly 80,000 should be brought back from Tripoli, and may be added to the above strength.

Triple Entente: France's peace strength should, the spring of 1914, amount to 860,000 (including 50,000 native troops) of which about 60,000 will be quartered in Africa. There will therefore be about 800,000 available in Europe.

Russia.—Hitherto Russia has had a peace strength of 1,267,000 in round numbers. When the two new army corps have been formed the peace strength should amount to 1,327,000 officers, non-commissioned officers and men.

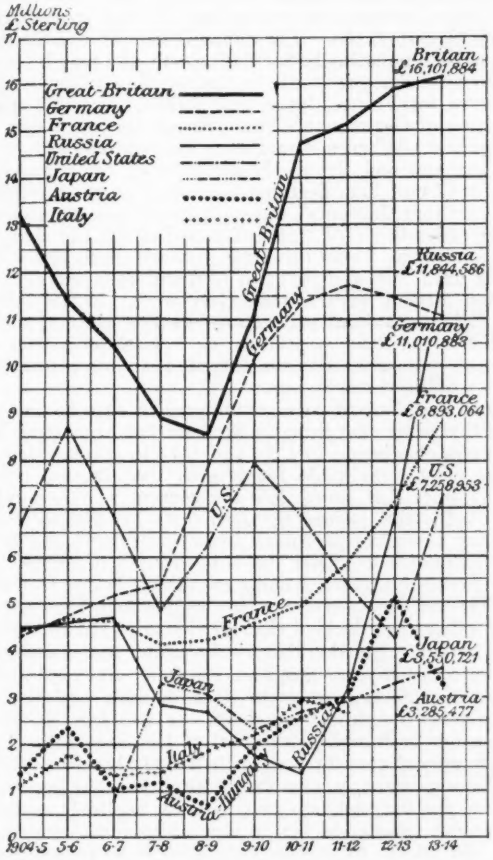
Great Britain.—The peace strength in Great Britain and Ireland amounts to about 145,000.

The foregoing seems to show that the land forces of the Triple Entente exceed those of the Triple Alliance by about half a million of men.—*United Service Magazine.*

NAVAL EXPENDITURE OF THE POWERS.—*The British Admiralty get Better Value for Cost of Construction than do other Powers.*—The contention of the First Lord of the Admiralty, in his recent speech at Manchester, that the expenditure of our navy now bore a less proportion to our oversea trade and national revenue than in the past years was of greater significance, and, perhaps, will be of more lasting influence, than his suggestion that we should not lay down any of the four battleships of next year's program if Germany agreed not to begin the construction of the two embraced in the program according to their navy law. The latter idea may be dismissed in the words of a semi-official communication issued from Berlin: "Mr. Churchill has found little support either in the English or in the German press. Whatever may be adduced against the practicability of Mr. Churchhill's idea, there can be no doubt about the English Naval Minister's good intention and the honesty of his utterances. Mr. Churchill did not say a word that could damage the friendly development of Anglo-German relations." There are many reasons why Germany should not accept the proposal. In the first place, Germany is not our only possible combatant, nor are we the only possible combatant of Germany. The foreign ships building in England would afford us an advantage in the event of trouble arising, because these could then be commandered for His Majesty's service. Moreover, battleships, to which Mr. Churchill's proposals are confined, constitute only a part of the fighting fleet. These conditions alone create grave difficulty in making an arrangement for cessation of battleship keel-laying even for one year. Admiral von Tirpitz, the chief of the German Admiralty, has this week given his dictum that the German Navy law will be carried on to its conclusion without hesitation.

The annual return showing the total naval expenditure during the past ten years, issued this week, throws considerable light on the subject of proposals for temporary cessation of battleship keel-laying. The most suggestive figures in the return are those applicable to the expenditure on ships, propelling machinery, armor, and armament; in other words, the votes of the different powers for the building and equipping of all types of warships.

By taking these alone, it is possible to eliminate variants and get down to the bedrock of naval strength. It is true that constructional work is undoubtedly less expensive in this country than in any other; consequently our expenditure represents a greater degree of fighting strength. It is not advisable to make deductions on this score on the cost per ton of displacement of a ship when completed, because this displacement includes fuel and stores, and the result is vitiated by variation in practice as to the weight of



CURVES SHOWING NAVAL EXPENDITURES OF DIFFERENT POWERS FROM 1904 TO 1913

fuel and stores carried by each ship. The tonnage of a ship ready for fighting, without such variable quantities as fuel and stores, is not available, and thus we are forced to be satisfied with the general conclusion that the British Admiralty get from 10 to 20 per cent greater value for expenditure on new construction than do other powers. Instead of giving the figures

for each nation, we have plotted them on the diagram which accompanies this article.

It will be seen that in the first three years of the decade embraced in the government return, practically all powers decreased their expenditure on munitions of naval warfare, except only Japan, which embarked on a program of new construction in order to strengthen its fleet after the war with Russia. Of the continental powers, Germany was the first to show a marked increase in expenditure on warships. Their total for the year 1908 and 1909 was nearly £1,900,000 greater than in the previous year, and in 1909 and 1910 there was a further increase, the expenditure in two years having gone up from £5,910,959 to £10,177,062. The expenditure for the United States, it will be seen, has been a markedly fluctuating one, and may be left out of the reckoning. No immediate response to the German action is visible in the expenditure curve for France, Japan and Russia. But this country recognized in the action of Germany a distinct reason for increasing expenditure on new construction. When one measures the relative need for naval construction in Germany and Britain in the light of the comparative extent of sea coast, size of merchant fleet and volume of over-sea trade of the two countries, the fact that Germany's expenditure on new warships was within £865,000 of our expenditure of 1908 and 1909 justifies the sharp advance in the British expenditure. From this time forward there was a rapid rise in Germany's vote until 1910 and 1911; in 1909 and 1910 our expenditure was only one million sterling greater than Germany's. In the following year, 1910 and 1911, it became about 3½ millions sterling greater, and this excess has continued, the German expenditure on new ships having slightly decreased since 1911 and 1912. For the current year our expenditure on new construction is 5 millions sterling more.

It will be seen that France only commenced in 1910 to increase her expenditure, and that since that time the increase has been from £4,977,682 to £8,893,064. Russia also began in 1910 and 1911 to increase her naval vote, and one of the most remarkable features of the diagram is the advance made by Russia since that time. For the current year her expenditure is next to that of Britain, exceeding Germany's by £834,000. Indeed, the available building resources of Russia are overstrained, and it is said that the Admiralty is unable to spend the vote granted it by the Duma. The extraordinary increase in the Russian expenditure is due to the fact that a great leeway has had to be made up for well-known reasons, and Russia has, rightly or otherwise, decided that all the ships should be built within the country. There is suggestion that a still further increase should be made by the beginning of a ten years program, involving an expenditure of £100,000,000 for the construction of eight dreadnoughts and the other units required to make up a fighting squadron. In this fact there is probably sufficient reason for hesitancy on the part of Germany to reduce the navy program already agreed upon by the Reichstag. Italy and Austria-Hungary are undoubtedly important factors in the situation, but figures for Italy's new construction for the past two years are not available, according to the British Government return; so far as they are given they are included in the diagram. The Italian expenditure has greatly increased probably at as great, if not a greater, rate than the Austro-Hungarian expenditure. For new construction the expenditure of the latter has doubled since 1910, being, for 1913, £3,285,477, while in 1912 it was £5,105,000, and in 1911 £3,125,000. The average for the three years was thus 3.8 millions sterling, whereas in 1906 and 1908 it was under 1 million sterling. We are thus fast moving towards a competition in naval expenditure in the Mediterranean as well as in the North Sea.—*Engineering.*

B.—THE EASTERN END OF THE TURCO-BULGARIAN BOUNDARY SHOULD STRIKE THE BLACK SEA AT THE 42D PARALLEL, AND NOT AS SHOWN

AREA OF BALKAN STATES
(in square miles)

State	Former area	Approximate increment	Present area in round numbers	Percentage of increase
Montenegro	3,506	2,074	5,600	60%
Albania	.....	.....	10,900	....
Servia	18,650	14,910	33,600	80%
Rumania	50,720	3,622	54,300	7%
Bulgaria	37,201	6,102[1]	43,300	16%
Greece	24,966	21,660[2]	46,600	87%
Turkey in Europe	65,370	—55,650[3]	9,700	—85%[3]

[1] 9,724 sq. miles acquired from Turkey minus 3,622 sq. miles ceded to Rumania.
[2] 16,582 sq. miles continental plus 5,078 sq. miles insular increment (including Crete). The area of the Aegean Islands, except Crete, was taken from Bevölkerung der Erde: VIII, pp. 43 and 121; of Crete, from the same; XIII, p. 117, *Ergaenzungsheft zu Petermann's Mitteilungen Nos. 101 and 163*, 1891 and 1909, respectively.
[3] Decrease.

POPULATION OF THE BALKAN STATES

States	Prior to Balkan War (in round numbers)	Present
Montenegro	285,000[4]	500,000
Albania	.....	900,000
Servia	2,960,000[5]	4,300,000
Rumania	7,250,000[6]	7,400,000
Bulgaria	4,340,000[7]	4,800,000
Greece	2,670,000[8]	4,600,000
Turkey in Europe	6,130,000[1]	1,600,000
	23,635,000	24,100,000

[4] Almanach de Gotha, 1913.
[5] Estimate for Dec. 31, 1911 (Almanach de Gotha, 1913).
[6] Census of Dec. 19, 1912 (Statesman's Yearbook, 1913).
[7] Census of Dec. 31, 1910 (Statesman's Yearbook, 1913).
[8] Estimated population, 1909 (Statesman's Yearbook, 1913).

—*Bulletin of the American Geographical Society.*

ANNUAL FINANCIAL REPORT OF THE SECRETARY AND TREASURER OF THE U. S. NAVAL INSTITUTE

TO THE OFFICERS AND MEMBERS OF THE INSTITUTE

Gentlemen.—I have the honor to submit the following financial report for the year ending December 31, 1913:

Itemized Cash Account

Receipts for the Year, 1913

Items	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Totals
Dues	$1,822 52	$401 80	$161 75	$149 00	$2,535 07
Subscriptions	530 74	228 91	193 61	313 45	1,266 71
Extra Publications	7,350 04	3,620 18	3,507 58	5,346 81	19,824 61
Proceedings	35 54	63 33	47 07	30 01	175 95
Advertisements	38 67	131 41	428 57	31 43	630 08
Interest on money invested	692 50	589 61	844 99	632 39	2,759 49
Binding	45 80	1 60	0 00	0 00	47 40
Postage received with orders	11 29	91 97	73 85	75 36	252 47
Life fee	0 00	0 00	0 00	26 00	26 00
Credits	0 00	0 00	0 00	8 53	8 53
Sundries	27 67	31 48	42 40	100 29	201 84
Totals	$10,554 77	$5,160 29	$5,299 82	$6,713 27	$27,728 15

EXPENDITURES DURING THE YEAR 1913

Items.	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Totals
Printing and binding Proceedings	$1,72	$1,476 54	$1,795 58	$1,520 22	$6,517 71
Printing and binding extra publications	1,460 12	3,135 70	1,888 01	1,903 78	8,387 61
Salaries	900 00	900 00	900 00	970 00	3,670 00
Contributors	928 00	1,105 50	965 00	755 00	3,753 50
Authors of books	763 60	25 00	403 80	408 80	1,601 20
Postage and telegrams	270 54	194 84	134 56	178 31	778 25
Expressage, freight and hauling	17 87	9 79	20 90	14 55	63 11
Prize Essay award	200 00	7 50	0 00	0 00	207 50
Honorable Mention award	305 00	0 00	0 00	0 00	305 00
Board of Control meetings	59 60	92 60	46 60	132 60	331 40
Refunds	11 21	1 75	5 59	23 69	42 24
Office expenses	30 24	20 61	10 10	6 20	67 15
Furniture	0 00	96 63	7 75	0 00	104 38
Advertising	0 00	35 22	31 95	13 05	80 22
Stationery	0 00	56 88	0 50	23 72	81 10
Rent safe deposit box	0 00	5 00	0 00	0 00	5 00
Purchase of books for sale	0 00	34 46	0 00	14 92	46 21
Subscription to Army and Navy Directory	0 00	0 00	1 00	0 00	1 00
Insurance	0 00	0 00	0 00	80 00	80 00
Sundries	92 53	18 29	5 05	8 00	127 04
Totals	$6,764 08	$7,216 31	$6,216 39	$6,052 84	$26,249 62

SUMMARY

Balance unexpended January 1, 1913	$13,100.82
Total Receipts for the year 1913	27,728.15
	$40,828.97
Disbursements for the year 1913	26,249.62
	* $14,579.35
Bills receivable for dues and binding	751.75
" " " subscriptions	112.43
" " " Proceedings	3.40
" " " advertisements	332.70
" " " extra publications	3,275.09
Value of back numbers of Proceedings	200.00
" " Institute property	300.00
" " extra publications	2,000.00
	$21,554.72
Liabilities	2,071.30
	$19,483.42

* The balance ($14,579.35) unexpended January 1, 1914, is distributed as follows:

Seamen's Bank for Savings	$ 3,000.00
Rhode Island Hospital Trust Co., Providence	3,170.82
Society for Savings, Hartford, Conn	3,217.18
Farmers' National Bank, Annapolis, Md	5,191.35
	$14,579.35

SECURITIES (BONDS) DECEMBER 31, 1913

Southern Railway 5 per cent Registered Gold	$ 6,000.00
Washington Railway and Electric Co., 4 per cent	2,000.00
Northern Pacific and Great Northern Co., 4 per cent	18,000.00
Potomac Electric Power Co., 5 per cent	2,000.00
Northern Pacific 3 per cent	12,000.00
Baltimore and Ohio ($7,053.14 of these bonds are the † Reserve Fund)	9,000.00
New York City, Registered, 4¼ per cent	7,000.00
	$56,000.00

† RESERVE FUND.—This, by the Constitution, is composed of the $3,050 originally credited to it, together with all life fees which have been or may hereafter be received, and the principal of this fund shall be held in perpetuity to guarantee the future interest of the life members. $7,053.14.

The operations of the year 1913 show a net profit of $1,478.53.

Respectfully,

E. J. KING,

Lieutenant Commander, U. S. Navy,

Secretary and Treasurer.

The books of the Naval Institute have been examined as from January 1, 1913, to December 31, 1913, and found to be correct, and the balance sheet verified.

G. W. LOGAN, Captain, U. S. Navy,

J. R. POINSETT PRINGLE, Commander, U. S. Navy,

J. T. TOMPKINS, Commander, U. S. Navy,

Auditing Committee.

NAVAL ACADEMY GRADUATES' ASSOCIATION

The Farragut Memorial Window Committee met in the city of Washington on December 2d, and effected an organization. Rear Admiral Watson was elected Chairman and Comdr. C. T. Jewell, Secretary-Treasurer. The question of the appointment of sub-committees was brought up, and it was decided that as the whole committee consisted of but seven members, it would expedite matters to have all questions decided by the whole committee. The Secretary-Treasurer was directed to ask for designs and bids from a number of firms, it being the intention of the committee to have a design settled upon, and the exact cost of the completed window known before appealing to the graduates for subscription. In this way it will be possible to state in the circular the minimum subscription required from each graduate in order to carry the project to a successful conclusion. There will be a second meeting of the committee in February.

The most difficult task the Secretary of the Association has is to keep track of the graduates in civil life. When an officer resigns the department is appealed to for the home address of the officer, and in many cases a letter to that address is returned unclaimed. Thereafter it is a matter of luck if his whereabouts is ascertained. It is therefore most earnestly requested that the secretary be kept informed of the address of every one entering civil life.

Below is a list of those graduates who have left the service and whose addresses are unknown. A number of these graduates have been lost track of for years and it is probable that some are dead. Others have left the service more recently. I would be glad to have some definite information in regard to any of them. A memorandum on a postal card will be sufficient.

Cook, Joseph J.	Date '41	Res., Dec. 9, '51, P. Midn.
Oakley, Eugene H.	'48	Res., May 9, '56, Lt.
May, Robert L.	'49	Wh. Ret., April 21, '66, Lt. Comdr.
Taylor, Jesse	'49	Res., Sept. 12, '59, Lt.
Gove, G. D.	Class '56	Res., Feb. 26, '63, Ens.

Smith, Beatty P.	'59	Dropped, July 9, '74, Lt. Comdr.
Backus, S.	'61	Wh. Ret., July 31, '66, Lt.
Wood, George W.	'61	Disch., July 3, '93, Comdr.
Haskins, B. F.	'61	Dropped, July 7, '64, Ens.
D'Orleans, Pierre	'63	Res., May 30, '64, Ens.
Breed, Cyrus W.	'65	Res., April 30, '75, Lt.
Vaughan, J. A.	'65	Res., Dec. 6, '70, Master.
Buford, Marcus B.	'65	Res., Jan. 1, '88, Lt. Comdr.
Stewart, David A.	'66	Res., March 12, '69, Ens.
Howes, Frederick A.	'67	Res., Dec. 1, '73, Master.
Nicholson, W. D.	'67	Res., June 12, '71, Master.
Payne, Frederick H.	'67	Res., Aug. 1, '84, Lt.
Fletcher, James R.	'68	Res., Sept. 1, '68, Midn.
Peck, John B.	'68	Res., June 7, '69, 3d Asst. Engr.
Ellery, Frank, Jr.	'70	Res., Dec. 31, '80, Master.
Bean, John W.	'73	Res., June 30, '78, Ens.
Wegmann, Albert	'74	Res., March 16, '75, Midn.
Reynolds, Edwin L.	'74	Res., April 18, '86, Lt. (J. G.)
Hoffman, Frank J.	'74	Res., June 11, '89, P. A. Engr.
Case, Daniel R.	'76	Res., Jan. 8, '79, Midn.
Fisher, Elstner N.	'76	Res., Jan. 15, '85, Ens.
Rogers, Henry H.	'77	Res., May 30, '79, Midn.
Biddle, Spencer, F. B.	'78	Res., Dec. 20, '81, Midn.
Ivers, Henry K.	'79	Res., July 1, '85, Asst. Engr.
West, George E.	'80	Res., Oct. 4, '83, Ens.
Huntoon, Fitz-Aubert	'80	Res., April 14, '90, Ens.
Manning, Charles E.	'80	Res., Jan. 30, '91, Asst. Engr.
Agee, Alfred P.	'83	Res., June 30, '85, N. Cdt.
Thompson, A.	'85	Res., March 1, '88, N. Cdt.
Pitner, Samuel E.	'85	Res., Sept. 20, '85, N. Cdt.
Johnson, Edwin Van D.	'86	Res., June 30, '88, N. Cdt.
O'Halloran, Thomas M.	'87	Res., June 30, '89, N. Cdt.
Stafford, Leroy A.	'88	Res., June 30, '92, 2d Lt. M. C.
Buck, William H.	'90	Res., Dec. 31, '02, Lt.
Carver, Marvin	'93	Res., June 14, '95, N. Cdt.
McCormack	'95	Res., July 27, '12, Lt. Comdr.
Marble, Ralph N. Jr.	'98	Res., Sept. 15, '03, Lt. (J. G.)
Faller, Guy W.	'98	Res., Jan. 1, '03, Ens.
Babcock, John F.	'98	Res., Dec. 31, '05, Lt.
Morgan, Charles E.	'99	Res., Sept. 6, '03, Ens.
Johnston, Huntington	'00	Res., Oct. 10, '02, Midn.
Landram, Clarence E.	'00	Disch., July 7, '06, Ens.
Petersen, Andrew A.	'02	Res., Feb. 13, '08, Lt.
Thompson, Rufus S.	'03	Res., Aug. 19, '05, Midn.
Smith, Roy C.	'05	Res., Sept. 23, '11, Lt.
Smith, Simeon B.	'05	Res., March 1, '12, Lt.
Neilson, Raymond P. R.	'05	Res., March 10, '07, Midn.
Hayes, William P.	'06	Res., Feb. 28, '12, Ens.

Harter, Robert L.	'06	Res., Feb. 21, '06, Midn.
Coffin, Vestal P.	'06	Res., July 14, '06, Midn.
Nixon, Warren C.	'07	Res., March 1, '12, Lt. (J. G.)
Barsett, Claude O.	'07	Res., March 31, '10, Midn.
Burford, Robert A.	'07	Res., Oct. 1, '10, Ens.
Howell, J. B.	'07	Res., Feb. 28, '13, Lt. (J. G.)
McCrary, Preston H.	'07	Res., Jan. 2, '13, Lt. (J. G.)
Howard, David, S. H.	'07	Res., Aug. 25, '12, Lt. (J. G.)
Spencer, Herbert L.	'07	Res., April 1, '12, Ens.
Torlinski, Michael J.	'07	Res., Sept. 30, '11, Ens.
Jewell, Joseph W.	'07	Res., Nov. 14, '11, Ens.
Gillmor, Reginald E.	'07	Res., Oct. 7, '12, Lt. (J. G.)
Pritchard, Earl W.	'07	Res., Dec. 5, '07, Midn.
Dallas, George M.	'07	Res., Jan. 12, '12, Ens.
Leonard, Emeric R.	'07	Res., May 13, '11, Midn.
White, Richard C.	'08	Res., July 1, '12, Ens.
Martin, Alfred G.	'08	Res., Aug. 17, '10, Midn.
Wilson, George F.	'08	Res., June 10, '10, Midn.
Earle, John H.	'08	Res., May 28, '08, Midn.
Clark, Joseph B.	'08	Res., July 25, '12, Ens.
McNeill, Andrew B.	'08	Res., March 1, '11, Midn.
Stoer, Charles H.	'08	Res., Sept. 20, '11, Ens.
Harris, Joseph S.	'09	Res., Dec. 1, '10, Midn.
Van de Boe, Hugh R.	'09	Res., Oct. 16, '11, Ens.
Butler, William P.	'09	Res. June 5, '09, Midn.
Bartlett, William C.	'09	Res., Aug. 31, '12, Ens.
Yost, Charles S.	'09	Res., Aug. 4, '11, Ens.
Allewelt, Robert L.	'09	Res., June 5, '09, Midn.
Henderson, Monroe I.	'09	Res., June 5, '09, Midn.
Vetter, William P.	'09	Res., June 5, '09, Midn.
Skeen, Dawson H.	'10	Res., June 4, '10, Midn.
Smith, Elwood S.	'10	Res., Nov. 7, '10, Midn.
Smith, Harold	'10	Res., Sept. 12, '10, Midn.
Osmun, Russell A.	'10	Res., May 1, '11, Midn.
Hammond, Theodore E.	'11	Res., Oct. 13, '11, Midn.
Mitchell, Stanley	'11	Res., May 20, '12, Midn.
Mayfield, Paul C.	'11	Res., June 3, '11, Midn.
Beach, Philip D.	'11	Res., June 3, '11, Midn.
Woodward, Kenneth C.	'11	Res., June 3, '11, Midn.
Brown, Martin L.	'11	Res., June 3, '11, Midn.
Rutter, Allan A.	'11	Res., June 3, '11, Midn.
Hoddick, Frederick G.	'11	Res., June 3, '11, Midn.
Waddell, William C.	'12	Res., June 8, '12, Midn.
O'Neil, Kirkman	'13	Res., June 7, '13, Midn.
Pendleton, Arvid	'13	Res., June 7, '13, Midn.
Sleeper, Paul de V.	'13	Res., June 7, '13, Midn.

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now enters upon its forty-first year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary, and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control, and a vote equal to one-half the number of regular and life members, given by proxy or presence, shall be cast, a majority electing.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control, and, if their report be favorable, the Secretary and Treasurer shall make known the result at the next meeting of the Institute, and a vote shall then be taken, a majority of votes cast by members present electing."

The PROCEEDINGS are published every two months and anyone may subscribe for them. The annual subscription is $3.00; single copies, 50 cents. Annual dues for members and associate members, $2.00. Fee for life membership, $30.00.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1915

A prize of two hundred dollars, with a gold medal, and a life-membership in the Institute, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. The award for the prize will be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1915. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the PROCEEDINGS of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the PROCEEDINGS of the Institute, after it leaves the hands of the Board.

4. If, in the opinion of the Board of Control, the best essay presented is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention" or such other distinction as the Board may decide.

5. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

6. Any essay not having received honorable mention may be published also, at the discretion of the Board of Control, but only with the consent of the author.

7. The essay is limited to fifty(50) printed pages in the PROCEEDINGS of the Institute.

8. It is requested that all essays be submitted typewritten and in duplicate, if practicable; essays submitted written in longhand and in single copy will, however, receive equal consideration.

9. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

E. J. KING,
Lieut. Commander, U. S. N., Secretary and Treasurer

SUGGESTED PRIZE ESSAY TOPICS

(a) "The Proper Organization and Administration of the National Fleet for the Conduct of a Great Campaign."

(b) "Theory vs. Practice in Naval Tactics."

(c) "Progressive Education of Naval Officers: A Discussion of the Requirements of (a) The Midshipman and the Naval Academy, (b) The Commissioned Officers and the Postgraduate and Specialty Courses, (c) Commanding and Flag Officers and the War College."

(d) "Is Our Present Training Service Adequate?"

(e) "Morale."

(f) "The Principles of Command."

LIST OF PRIZE ESSAYS

1879

Naval Education. Prize Essay, 1879. By Lieut.-Com. A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut.-Com. F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How may the Sphere of Usefulness of Naval Officers be extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887

The Naval Brigade: its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888

Torpedoes. Prize Essay, 1888. By Lieut.-Com. W. W. Reisinger, U. S. N.

1891

The Enlistment, Training and Organization of Crews for our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892

Torpedo-boats: their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894

The U.S.S. Vesuvius, with Special Reference to her Pneumatic Battery. Prize Essay, 1894. By Lieut.-Com. Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut.-Com. Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention, 1896. By Lieutenant John M. Ellicott, U. S. N.

1897

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

1898

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut.-Com. Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903

Gunnery in Our Navy. The Causes of its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905

American Naval Policy. Prize Essay, 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear-Admiral Stephen B. Luce, U. S. N.

1906

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut.-Com. A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906. By Pay Inspector J. A. Mudd, U. S. N.

1907

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A few thoughts on our next step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut.-Comdr. Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENSE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut.-Commander Yates Stirling, U. S. N.

1909

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotten, U. S. N.

1911

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut.-Commander T. D. Parker, U. S. N.

1913

The Greatest Need of the Atlantic Fleet. Prize Essay, 1913. By Lieut.-Commander Harry E. Yarnell, U. S. N.

NAVY DEPARTMENT ORGANIZATION. A Study of Principles. First Honorable Mention, 1913. By Commander Yates Stirling, Jr., U. S. N.

TRAINED INITIATIVE AND UNITY OF ACTION. Second Honorable Mention, 1913. By Lieut.-Commander Dudley W. Knox, U. S. N.

NOTICE TO MEMBERS

More members, both regular and associate, are much desired. Any increase in membership invariably means a larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

NOTICE TO MEMBERS

More members, both regular and associate, are much desired. Any increase in membership invariably means a larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

E. J. KING,
Secretary-Treasurer.

CONSTITUTION, Art. VII, Sec. 8.—"The annual dues for regular and associate members shall be two dollars, payable upon joining the Institute and upon the **FIRST DAY OF EACH SUCCEEDING JANUARY.** The fee for life membership shall be thirty dollars." There is no initiation fee.

.....

.....*191*

To the Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a regular member of the U. S. Naval Institute from this date.

Very truly yours,

.....

.....